PROJECT MANUAL

Willow School
Lansing, Michigan

VOLUME 1

Bid Package 3

Friday, June 7, 2024

Food Service Equipment

CONSTRUCTION MANAGER

The Christman Company
208 N. Capitol Avenue
Lansing, MI 48933-1357
517-482-1488

Architect
Kingscott
801 Broadway Ave NW Suite 306
Grand Rapids, MI, 49504

Mechanical & Electrical Engineer
SES Engineering
4000 West 11 Mile Rd
Berkley, MI 48072

Site Engineer
Spalding Dedecker

Structural Engineer
Robert Darvas Associates
440 S. Main St.
Ann Arbor, MI 48104

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SECTION 00025

Project: **Willow School**
Project Description

Owner: **Lansing School District**
519 West Kalamazoo Street
Lansing, MI, 48933

Architect/Engineer: **Kingscott**
801 Broadway Ave NW Suite 306
Grand Rapids, MI, 49504

Construction Manager: The Christman Company
208 N. Capitol Avenue
Lansing, MI 48933-1357
517-482-1488

Sealed proposals for all work categories as described in the Project Manual for the above project will be received no later than Thursday, June 27th, 2024 at 2:00 PM. Proposals must be received at the Lansing School District Purchasing Office, ATTN: Jon Laing, 519 W, Kalamazoo St., Room 208, Lansing MI. The Lansing School District will not consider any late, faxed, or electronic mail bids. Bids will be opened publicly and read aloud. All bids must be presented on the forms provided in the contract documents.

Triplicate proposals shall be submitted to the Construction Manager at the above address on the proposal form provided, in a sealed envelope clearly marked **WORK CATEGORY NO. 29**, and shall be identified with the project name and the bidder's name and address.

All contractors bidding on work must be bondable and must include in their bid the cost for furnishing a Co-Obligee Labor and Material Payment Bond and a Co-Obligee Performance Bond. On the proposal form the contractor will identify a cost to be deducted from their bid should bonds not be required.

There will be a Virtual pre-bid conference on Wednesday, June 12, 2024 at 9:00 AM conducted by the Construction Manager. It is strongly recommended that contractors attend the pre-bid conference.

Join the virtual pre-bid conference via the options below;

Join the meeting now Meeting ID: 251 032 817 517 Passcode: yFAAt4	Dial in by Phone +1 517-325-9971 524348730	Join by video conference device Tenant key: 130098559@teams.bjn.vc Video ID: 117 952 931 6

All questions are to be directed to the Construction Manager. No direct contact with the Owner or Architect is requested.

Each Proposal shall be accompanied by a certified check, cashiers' check, money order, or bid bond made payable to The Christman Company in an amount not less than five percent (5%) of the base bid as a bid security. The Bid Security of Bidders under consideration will be returned immediately after award of contracts by the Construction Manager. The amount of the guarantee shall be forfeited to the Owner if the successful Bidder fails to enter into a contract and furnish required bonds and insurance within 30 days after award of contracts.

All proposals submitted shall remain valid for a period of sixty (60) days after the bid date. The Owner, Architect and Construction Manager reserve the right to waive any irregularities, reject any or all proposals, or accept any proposal, which, in their opinion, will serve their best interest.

Any questions shall be emailed to projects@lansingschools.net no later than June 18th, 2024, 5:00PM.

END OF SECTION 00025

ARTICLE 1, SCOPE OF PROPOSALS

1.1 This is a "Construction Manager Project" for which The Christman Company is the "Construction Manager" For this portion of this project the successful bidders will become "Trade Contractors" and will enter into "Trade Contracts" with the Construction Manager. The Construction Manager will administer separate Trade Contracts for all Work Categories involved in the project. The project will be controlled, coordinated, and scheduled by the Construction Manager on behalf of the Owner.

1.2 Provisions shall be such that the Trade Contractor will assume the Construction Manager's obligations to the Owner for the portion of the work performed by each Trade Contractor.

1.3 Proposals: Separate proposals for the Work Categories included in this phase of the construction will be received by the Construction Manager. The time and place where proposals shall be received and a listing of the Work Categories included in this phase of the work are included in the Advertisement for Bids.

ARTICLE 2, BIDDER'S REPRESENTATION

2.1 Each Bidder by making his bid, represents that he has read and understands the bidding documents, and that they visited the site and familiarized himself with the local conditions under which the work is to be performed. No plea of ignorance of conditions that exist, or of any other relevant matter concerning the work to be performed in the execution of the work will be accepted as justification for failure to fulfill every detail of all the requirements of the Contract Documents. The Bidder, if awarded the Contract, shall not be allowed any extra compensation by reason of any matter or thing concerning which such Bidder did not fully inform himself prior to the bidding.

ARTICLE 3, BIDDING PROCEDURES

3.1 Proposals shall be submitted in triplicate, only on the forms provided by the Construction Manager, all blank spaces shall be fully filled in, including Addenda, Alternates, Price Breakouts, Unit Prices and Bidder's Certificate where applicable. All designations and prices shall be fully and clearly set forth with the amount of the bid stated in words and repeated in numerical figures. In cases of variations, the worded amount shall prevail. Erasures or other changes in the bid shall bear the signature of the Bidder. Insert N/A in those blanks on the Proposal Form that are not applicable. Separate Proposal Forms shall be prepared for each Work Category.

3.2 The bids shall be on the basis of a Lump Sum. Proposals shall not contain any added recapitulation of the work to be done as otherwise the proposal may be declared irregular. Oral, telegraphic or telephonic modifications of the work and/or the bid amounts shall not be considered.

3.3 The Architect or Construction Manager will make clarifications and corrections by the issuance of an addendum to all Bidders recorded in the Construction Manager's office as having in their possession a set of bidding documents. Addenda shall also be issued to all plan rooms in which bidding documents are on file.

3.4 It shall be the responsibility of the Bidders on record to provide all of their prospective sub-bidders with the information contained in any addenda.

3.5 Duplicate proposals shall be submitted in an opaque envelope, clearly marked "PROPOSAL FOR WORK CATEGORY NO. _____", and shall be identified with the Project Name and the Bidder's name and address.

3.6 Proposals for this phase of the work will be received at the time and place indicated in the "Advertisement for Bids".

3.7 An award of Contracts: Each Work Category or combination of Work Categories will be awarded based on the dollar value of the proposal, qualifications of the Contractor, his ability to perform the work, and in the best interest of the Owner.

ARTICLE 4, EXAMINATION OF THE SITE

4.1 Each Bidder shall carefully examine the site of the project and surrounding territory; the means of approach to the site, and the structure of the ground, and make all necessary investigations required to inform himself thoroughly and fully as to facilities for delivering, storing, placing and handling of materials and equipment, and to inform himself fully as to all difficulties that may be encountered in the complete execution of all work in accordance with the Contract Documents.

4.2 Should a bidder find apparent discrepancies in, or omission from the Contract Documents, or should he be in doubt as to their true meaning, or should he have any questions regarding any work or material intended, then such Bidder, either Trade Contractor or Trade Subcontractor, shall submit to the Architect, through the Construction Manager, a written request for an interpretation thereof. The person submitting the request shall be responsible for its prompt delivery and such request must be delivered to the Architect by the Construction Manager at least five days before the opening of proposals.

4.3 Any verbal information obtained from, or statements made by a representative of the Owner, Architect, or the Construction Manager at the time of examination of the Contract Documents or Site shall not be construed as in any way amending the Contract Documents. Only such corrections or addenda as are issued in writing to all Bidders shall become a part of the Contract. Neither the Owner, the Architect, nor the Construction Manager shall be responsible for verbal instructions.

ARTICLE 5, MODIFICATION OR WITHDRAWAL OF BID

5.1 Bids submitted prior to the time and date designated for receipt of Bids may be modified or withdrawn only by notice to the party receiving Bids. Such notice shall be in writing over the signature of the Bidder, and must be received prior to date and time set for receipt of Bids. Any modification shall be so worded as not to reveal the amount of the original Bid.

ARTICLE 6, REJECTION OF BIDS

6.1 The Bidder acknowledges the right of the Construction Manager, Architect, and Owner to reject any or all bids, and to waive any informality or irregularity in any bid received, or to accept any bid which in the opinion of the Construction Manager, Architect, and Owner shall serve their best interests. In addition, the Bidder recognizes the right of the Construction Manager, Architect, and Owner to reject a bid if the Bidder failed to submit on the date and time required by the bidding documents, or if the bid is in any way incomplete or irregular, including a bid security, if required, is not received with the bid proposal.

ARTICLE 7, PERFORMANCE CO-OBLIGEE BOND AND LABOR & MATERIAL PAYMENT CO-OBLIGEE BOND OWNER AND CONSTRUCTION MANAGER

7.1 The Construction Manager may, prior to the execution of the Contract, require the successful Bidders to furnish Co-obligee bonds, written in favor of the Owner and the Construction Manager, covering the faithful performance of the Contract and the payment of all obligations arising thereunder in an acceptable form to the Owner and the Construction Manager, and with such sureties secured through the Bidder's usual sources as long as the surety is licensed to do business in the State of Michigan and holds a minimum "A.M. Best" rating of A. Bonds shall be in the amount of 100% of the Contract sum. The premium for such bonds shall be paid by the Bidder. A space has been provided on the Proposal Form for the Bidders to indicate the amount that shall be deducted from their proposals if Bonds are not required. Should they be required, the Bidder shall deliver the bonds to the Construction Manager not later than the date of execution of the Contract.

7.2 The Bidder shall require the attorney-in-fact who executes the bonds on behalf of the surety, to affix thereto a certified and current copy of his power of attorney indicating the monetary limit of such power.

ARTICLE 8, VARIATIONS FROM MATERIALS SPECIFIED

8.1 Wherever materials are specified using names of specific manufacturers, the purpose is to establish a standard of quality and design, and not to limit competition. Contractors desiring to use materials of manufacturers other than those specified, shall indicate such material, manufacturer, and change of price, if any, in the space provided under the heading "Variations from Materials Specified" on the Proposal Forms. BASE BID PROPOSALS SHALL INCLUDE ONLY MATERIALS SPECIFIED. Variations, if accepted, shall be incorporated in the Contract, and the Contract Price adjusted accordingly, and no other materials shall be allowed accept upon written authorization of the Architect, Construction Manager, and Owner.

ARTICLE 9, THE CONTRACT FORM

9.1 Unless otherwise provided in the Bidding Documents, the Agreement for the Work shall be between the Trade Contractor and the Construction Manager on the contract form referenced in the Standard form section of the Project Manual (The Christman Company subcontract agreement). By submitting your bid the Trade Contractor fully agrees to accept **ALL** terms

and conditions of The Christman Company Subcontractor Agreement without modification.

ARTICLE 10, TIME OF COMPLETION

10.1 Each Bidder, as evidenced by submitting a proposal, shall agree to abide by the construction schedule dates as indicated in the Contract Documents, as developed during the post bid interview, scheduling meetings, and as required by Construction Manager. **The completion schedule for this project shall be met without exceptions.**

ARTICLE 11, QUALIFICATION OF BIDDER

11.1 The Owner, Architect, and Construction Manager may make such investigations as they deem necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish all such information and data for this purpose as the Construction Manager may request within 24 hours, including a list of projects completed, a financial statement, organization of the firm, etc. The Owner reserves the right, based on the advice of the Construction Manager and Architect, to reject any bid if the evidence submitted by, or investigation of such Bidder fails to prove that such Bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein.

ARTICLE 12, TAXES AND CONTRIBUTIONS

12.1 It is understood that the bid prices stated shall include all applicable Federal, State or other Governmental Division taxes and assessments. Also, all contributions for unemployment compensation, health and welfare, old age benefits or other purposes now or hereafter effective during the term of the contract, and the Owner and Construction Manager shall not be liable for any additional charges therefore.

ARTICLE 13, WARRANTY

13.1 All work shall be guaranteed for a period of at least two (2) years and/or as more specifically stated in the contract documents after final payment but not earlier than substantial completion as determined by the Architect, and all service within that period shall be rendered without charge to the Owner.

END OF SECTION

00201 - The Construction Manager will be located at 208 N. Capitol Avenue, Lansing, Michigan, 48933-1357 for questions regarding this Bid Package. Any questions regarding information contained in this Project Manual will be answered following a written request to the Architect through the Construction Manager, and clarified in an addendum. **Under no circumstances should any prospective bidder call the Owner or Architect for clarification of the Bidding Documents.**

00202 - AIA CONTRACT FORMS

Sample AIA Documents are available for review and reference in the Construction Manager's Main Office.

00203 - AIA STANDARD FORM FOR GENERAL CONDITIONS

AIA Document A201\2007, "General Conditions of the Contract for Construction as modified for this project," is available for review at the Construction Managers Main Office.

00204 - GEOTECHNICAL INVESTIGATION

1. A geotechnical investigation report has been prepared for the site by a geotechnical consultant.

2. Copies of the geotechnical investigation report are available in the specifications.

3. The Contractor is cautioned that the geotechnical investigation report was prepared during early preliminary design stages, and as such, references to elevations, dimensions, loadings, quantities and the like, may not coincide with the building as designed. The Contractor shall coordinate between the geotechnical investigation report and the contract documents.

4. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner and Architect will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for convenience of the contractor.

5. Additional test borings and other exploratory operations may be made by Contractor at no cost to the Owner.

00205 - PRELIMINARY CONSTRUCTION SCHEDULE NARRATIVE

1. Time is of the essence on this project. The Project sequencing will be scheduled by the Construction Manager and must be adhered to by all Trade Contractors. Time, labor, material, equipment and possible cost implication of this sequencing and others not fully conceived or described prior to the time of bidding, shall be included in base bid.

   A preliminary schedule is included for reference only. It is emphasized that start dates for work may shift. The bidder shall familiarize himself with expected

maximum durations and shall include in his proposal sufficient manpower to meet these requirements. All milestone dates are approximate and are to be used as guidelines for the Trade Contractor’s basis for bid.

3. It is the Trade Contractor's responsibility to establish which items of work within the scope of his work category will be affected by the Owner's or other Trade Contractors operations and coordinate and schedule completion of his work accordingly at no cost to the Owner.

END OF SECTION 00200

The Work Category (W.C.) Description is included as a guide for Prospective Bidders to summarize the scope of work involved with the work category. The description included is **not** a final summary of the scope of work and should not be construed as such. **All** Contract Documents should be used, as a reference in preparing the Bid Proposal and any omissions in the proposal does not relieve the successful bidder of the responsibility to perform this work.

W.C. No.	Category Description	Specification Reference
29	Food Service Equipment	Division 00, Division 01, 113013, 114000

Work Category No. 00 – General Requirements for All Subcontractors

Work Included:

1. This is not a prevailing wage project. This project will be funded IN PART by the 2022 Bond and Operating General Funded Capital Projects Fund.

2. All permits, fees, inspections and approvals required by governing jurisdictions are included within base bid. Coordinate well in advance (at least 24 hours), required inspections and testing with the Construction Manager. This will include liaison between state and local agencies to ensure code compliance and for securing approval for the facility.

3. Excessive noise and vibration creating equipment shall be prohibited within close proximity of existing Structures/Buildings or occupied spaces. All proposed equipment scheduled for project shall be reviewed with the Construction Manager prior to delivery onsite.

4. Cleanup is required on a daily basis, and/or as directed by the Construction Manager. Cleanup dunnage, shipping materials and associated materials/debris generated from installation and dispose of properly. At no time will shipping containers, crates, materials, piles of debris, tarps, boxes, etc. be left on site, un-attended and unsecured, subject to unsafe conditions (i.e. access, fire and slip hazards and wind blown debris).

5. Mockups; full-size physical assemblies that are constructed on site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not samples. Unless noted otherwise, approved mockups establish the standard by which the work will be judged.

   A. Integrated Exterior Mockups; Mockups of the exterior envelope erected in place, consisting of multiple products, assemblies, and subassemblies.

6. At least two (2) weeks prior to starting on-site, meet with the Construction Manager, Architect and Engineer to discuss and resolve any issues relating to status of material procurements, site conditions, access, staging/storage requirements, safety, testing, sequencing and scheduling of work.

7. Any work that could interfere with existing owners operation, i.e. use of certain roads, parking lots, access to buildings, shall require pre-task planning with the Construction Manager and shut-down notification requests shall be prepared (72) hrs in advance of any work being scheduled. Pre-task planning shall review and discuss scheduling, coordination with Owner operations, working durations, safe practices and procedures.

8. Protect existing structures, equipment, and finishes, including new work in place, from damage during the performance of this work category. Any protection removed to facilitate other work shall be reinstalled / replaced by the trade needing access.

9. Include all layout and engineering for each work category. Unless otherwise indicated in Section 00210, two control lines and one bench mark will be provided by the Construction Manager for Trade Contractor use.

10. Prior to commencing with installation, verify all field conditions and measurements and report any discrepancies to the Construction Manager.

11. Whenever possible all embeds to be furnished to other trades shall be fabricated / modified by the

providing contractor with holes / tabs, etc to allow easy for installation by the installing contractor.

12. Provide full-time on-site supervision during the performance of your work. Supervision will be responsible for coordination, scheduling, safety, manpower, and other activities necessary to achieve safety, quality and scheduling requirements set forth under this work category. Supervision shall not be removed from this project without prior written consent and approval of the Construction Manager.

13. Full compliance with all site specific rules and regulations, including (but not limited to) OSHA, State Authorities, Local Authorities, and the Construction Manager. This subcontractor shall submit, prior to performing any work on-site, a copy of their site specific safety program/manual.

14. Should Subcontractor require on-site trailer or storage units, Subcontractor shall obtain approval from the Construction Manager on size, count and where to locate, prior to delivery on-site. Subcontractor to arrange and pay for service to trailers, including (but not limited to) electrical, phone, etc.

15. For material deliveries, if traffic control is required, Subcontractor to arrange manpower accordingly and provide signage, barricading, flagman etc., necessary for the safe performance of own work and protection of the public. Staging, storage on-site, and all deliveries required to support this installation must be reviewed and approved in advance by the Construction Manager.

16. Furnish and receive all required materials and deliver FOB jobsite. All deliveries shall be closely coordinated with the Construction Manager and 72 hour advance notice shall be given prior to delivery. Unless noted otherwise, deliveries must be coordinated to be complete with unloading during normal working hours.

17. This subcontractor will receive and handle all respective material and properly store/protect before, during and after installations. Excessive and out-of-sequence deliveries will be prohibited and subject to re-handling and removal offsite as directed by the Construction Manager.

18. Unless noted otherwise in Section 00210, furnish all hoisting, lifting, scaffolding, and handling to complete your own work.

19. Hoisting of materials and equipment over occupied areas will not be permitted, unless areas below are vacated or occupancy access is controlled during lifting. Each subcontractor will be required to notify Construction Manager seven (7) days in advance of required hoisting over occupied areas. Pre-Task planning and shut-down notifications will be required to assure minimum interruptions to Owner operations. In general, any hoisting equipment required to be used on-site must be reviewed in advance with Construction Manager for coordination of site logistics, safety procedures (including FAA approvals if required), access, lift swing areas, duration and overall activities relating to this hoisting equipment.

20. Approved O&M manuals are required at least 2 weeks prior to equipment start-up, start of warranty, and Owner training, but no later than thirty (30) days prior to substantial completion.

21. In the event of any jurisdictional or labor issues, the subcontractor assigned the work shall arrange to complete all work as required to avoid any interruptions/continuity of work on this project at no additional cost. All labor requirements pertaining to the project will be met.

22. Cooperate fully with representatives from Architect, Engineer, Owner, Construction Manager and independent testing agency, and allow for in progress inspections, including providing access to areas of work, when required.

23. This project may require multiple phases, which will require re-mobilization. All costs for multiple phasing shall be included.

24. Each Trade Contractor shall assume full responsibility for all pre-ordered products after their arrival at

this designated location. This includes transportation, storage, start-up, warranty services, and installation in accordance with the General Conditions unless otherwise specified.

25. Critical Scheduling and Sequencing of Work:

The Construction Manager shall provide overall scheduling and coordination for the entire project. All Trade Contractors shall acknowledge the Construction Manager's right to establish and set up, or subsequently modify the sequencing and scheduling of all work on this project for the earliest completion and/or benefit to the Owner. More restrictive sequencing to coordinate the Owner's on-going operations and/or for the coordination of the various trades shall be spelled out by the Work Category descriptions or as otherwise directed by the Construction Manager. All Trade Contractors agree to cooperate and alter their operations to maintain these more specified restrictions and sequences of the work.

A. Subcontractor agrees to work concurrently with other subcontractors and the Construction Manager, according to the Master Project Schedule.

B. Subcontractor shall confirm fabrication lead times, installation durations and sequencing for their Work in writing within two weeks of award, and report any discrepancies to Construction Manager.

C. Scheduling updates and proper coordination and communication with other trades shall be accomplished as follows:

- Weekly sub-progress meetings
- Safety meetings, BIM meetings, scheduling meetings, pre-installation meetings, etc.

26. Construction Waste Management And Disposal – Review Spec Section 017419 Construction Waste Management And Disposal

27. General Commissioning Requirements – Review Spec Section 019113 General Commissioning Requirements.

28. Indoor Air Quality Management Plan – During Construction. Comply with site specific IAQ Management Plan for this project.

End of Work Category No. 00

Work Category No. 29 Food Service Equipment

Work Included:

The subcontractor shall timely perform all Precast, as detailed below, in accordance with the contract documents (including Bidding Requirements, Proposal Section, Contract Forms, General Conditions, Supplemental Conditions, General Requirements, Addenda, etc.), including, but not limited to, the following Specification Sections and Work Scope Items. Unless otherwise noted, this contractor is responsible for all items specified in the following specifications sections:

Reference Work Category Index

Work Category Notes:

The following details and notes are included in this Work Category; this list is to clarify the specific items noted below and does not exclude other details or otherwise limit the scope of work for this Work Category.

1. Provide and install food service equipment and associated accessories for a complete installation.
2. Furnish and install fire protection system for food service equipment as necessary for a complete installation. Coordinate with WC 28 for connection to building fire alarm system.
3. Furnish drawings showing size and location of concrete recesses required for Food Service Equipment to Construction Manager. Installation of these recesses by others.
4. Provide patching and repair for all damage to finish surfaces resulting from this WC's work.
5. Provide sleeves and coring for remote compressors/condensers, line sets, start up.
6. This contractor to provide a separate, dedicated visit for owners training after all food service equipment has been commissioned and training manuals have been furnished for owner training.
7. Schedule to receive, unload, erect, rig, hoist, and place all equipment by own forces. Turn over to respective trades for final connections.
8. Provide full time on site foreman to coordinate, instruct and facilitate installation for final connections for all food service equipment. Additionally, this person shall be present for the fire marshal and health department site inspections.
9. Include applicable Health Department permit(s) and fee(s) as necessary to obtain Approval Certificate from applicable Health Department for food service equipment. Coordination of inspections from the Health Department is the responsibility of this WC. This WC will also coordinate and ensure that the punch list items from the inspecting agency are completed by other effected trades and will call for a re-inspection (if necessary) and secure the certificate of occupancy for this area for the owner to occupy in the timeframe indicated in the construction documents.
10. This WC will be responsible to coordinate other trade contractors for corrections to equipment and reschedule final inspection(s) if necessary and obtain final approval form Health Department consistent with the Construction Schedule.
11. Final cleaning and sanitization of all food service equipment, including floors, walls, and ceilings as necessary to obtain Approval Certificate by appropriate Health Department.
12. Full compliance with all safety regulations and requirements of OSHA, MIOSHA, State Authorities, Local Authorities and the Construction Manager.
13. Coordinate all blocking required for this trade work with WC20 prior to wall construction. Blocking to

be by others (WC20).

14. All components of food service equipment shall be completely wired an dipped up to the point of final connection with electrical piping systems.
15. Food service equipment contractor shall provide inventory by equipment item and furnish loose to mechanical electrical systems contractors all hardware required for food service equipment final connections.
16. Receiving of all food service equipment, uncrating and proper disposal of packing materials, and inspection of equipment and replacement of damaged material/units during the time specified in the project schedule are the responsibility of this WC.
17. Complete assembly and installation of all shelving and storage rack systems.
18. Supply and install equipment, tables, racks, carts, etc., as specified.
19. Compliance with local codes for Health Department approval.
20. Include all layout required for the performance of this work category. Coordinate locations of all floor mounted and under floor electrical devices with WC 28 and floor sink/drain locations with WC 27.
21. This WC will make periodic site visits as requested by the construction manager to review and coordinate work provided by other trades that is in conjunction with the food service equipment. This will include but is not limited ot trade coordination meetings and health department application submissions. This includes a preinstall drywall visit and a visit prior to installing drywall on metal stud walls.
22. Caulking and sealants for this trade's work. Include all required penetrations, and sealing of same, including but not limited to ceiling decks, floors, walls, etc.
23. Coordinate rough in and infill connections with other trades and indicate on a dimensioned layout shop drawing.
24. Complete the installation and testing of all food service equipment, Include un-packaging and cleaning of equipment and smoke capture testing of hoods, Provide documentation and demonstration of the required testing to the construction Manager prior to Health Inspections.
25. This WC will be responsible to furnish hoods as indicated. Connection of the hoods to the air handling units and exhaust fans by others (WC27).
26. Provide clean up as required for the performance of this work. The Christman company will provide dumpsters. Each contractor will be required to separate and dump debris in the appropriate containers.
27. Furnish access panels where required for the wall and ceilings that are not shown on the drawings but are necessary for the food service systems.

Specific Notes and Details:

The following details and notes are included in this Work Category; this list is to clarify the specific items noted below and does not exclude other details or otherwise limit the scope of work for this Work Category.

1. This work category is responsible for all equipment indicated in the Food Service Equipment written specification and shown on FSE drawings
2. Responsible for coordination with adjacent trade contractors for final connections of Food Service Equipment to the building's mechanical, plumbing, and electrical system.
3. Responsible for any permits and inspections
4. Provide and install all residential appliances (including but not limited to washer, drier, microwaves, fridges,

mini-fridges, etc.)

Related Work by Others:

1. Final electrical connections by WC28
2. Final mechanical and plumbing connections by WC27
3. Tie in building fire alarm system by WC28
4. Millwork by WC20.
5. Stainless steel shelf on wall brackets shown on A3.1B detail 1 by WC20.

Allowances:

This Contractor shall include in their Base Bid a Construction Manager's allowance of $0. Reference Section 01020 for specific instructions on allowances.

Unit Prices:

Unit Prices are to be complete furnished in-place operations, and include all costs, incidental materials and work, insurance, fringes, bonds, engineering, overhead and profit. Reference the Trade Contract Proposal form for unit pricing required.

End of Work Category No. 29

Trade Contract Proposal
Pre-Submission Checklist

- ☐ Trade Contract Proposal Form completely filled out?
- ☐ Form signed by authorized officer of firm?
- ☐ Costs for Performance and Labor & Material Bond costs excluded from base bid proposal sum but amount included in break out?
- ☐ All taxes included in base proposal sum?
- ☐ Bid security (bond or certified check or money order) of at least 5% of base proposal sum included?
- ☐ Requested alternates & unit prices quoted?
- ☐ Sworn & Notarized Familial Affidavit for Lansing School District?
- ☐ Sworn & Notarized Familial Affidavit for Kingscott & Christman?
- ☐ Non-Discrimation Certification included in your proposal?
- ☐ Iran Sanctions Certificate and Act Certificate included?
- ☐ Affidavit of Bidder – Non-Collusion included with your proposal?
- ☐ Legal Status of Bidder Certificate included in your proposal?
- ☐ All information (proposal, bond, etc.) Submitted in triplicate?
- ☐ Proposal submitted in sealed envelope per specifications?

TRADE CONTRACT PROPOSAL FORM

WORK CATEGORY NO. 00 and _____ Date: _____

TO: The Christman Company
208 N. Capitol Avenue
Lansing, MI 48933-1357

Re: Willow School
1012 W Willow St,
Lansing MI 48915

Gentlemen:

Having carefully examined General Conditions, Supplementary Conditions, General Requirements, Advertisement for Bids, Instructions to Bidders, Proposal Section, Specifications, Drawings, all Addenda issued, Work Category Descriptions, and understanding the scope of work involved in this Work Category (ies) and those that interface with it (them), the undersigned does hereby propose to furnish all labor, materials, insurances, taxes, tools, equipment and services to complete all work required for the Work Category(ies) indicated in accordance with the Work Category Description and the Contract Documents prepared by _____.

BASE PROPOSAL SUM:

_____

_____ ($_____)

PERFORMANCE & PAYMENT BOND: The Trade Contractor may be required to furnish a Co-Obligee Labor & Material Payment & Performance Bonds for the full contract amount.
The name of the Bonding Company is: _____.
The sum of ($_____) to cover cost of furnishing these bonds is ***added to*** the base bid.

EXPERIENCE MODIFICATION RATING (EMR):
List the EMR for your firm as determined by your insurance carrier for the past three (3) years.
2023 _____ 2022 _____ 2021 _____

ADDENDA: The following Addenda have been received, are hereby acknowledged, and their execution is included in Bid Sums listed herein.
No _____ Dated _____ No _____ Dated _____ No. _____ Dated _____

TIME AND MATERIAL RATES: Provide labor rates below for all onsite labor.

Labor rates listed below include the following:

Cost of labor including Michigan Single Business Tax, Social Security and Medicare, Federal and State Unemployment Tax, and Fringe Benefits Under Collective Bargaining Agreements, and Worker's Compensation Insurance. The rates listed below do not include overhead and/or profit. These rates are only for additions and/or deletions to the contract that could not have been anticipated at the time of the bid.

TRADE CONTRACT PROPOSAL FORM

WORK CATEGORY NO. 00 and _____ Date: _____

	TRADE	STRAIGHT TIME	SHIFT TIME	1 1/2 TIME	DOUBLE TIME
1					
2					
3					
4					
5					
6					

OVERHEAD AND PROFIT (FOR FUTURE CHANGES): Overhead and Profit shall include the following: Supervision, Superintendents, Commercial General Liability and Umbrella Insurances, Wage of Time Keepers, Watchmen and Clerks, Small tools with material value of less than $1,500.00. Incidentals, General Office Expense, and all other expenses not included in Labor Rates as listed above. The percentage fee for Overhead and Profit on the Contractor's own work shall be 15% of net cost. The percentage fee for Overhead and Profit on Subcontractor's work shall be 5% (see log).

UNIT PRICES:
Costs to conform with R454b ILO R410a $ _____ (Add/Deduct)

VOLUNTARY ALTERNATIVES (Variations From Materials Specified):
Undersigned proposes the following voluntary alternates for materials and/or equipment specified, it being understood that, should any voluntary alternate(s) be accepted by the Owner, applicable amount(s) hereinafter listed will be added to or deducted from the Base Bid. (No voluntary alternates are required)

1. _____ $ _____ (Add/Deduct)
2. _____ $ _____ (Add/Deduct)
3. _____ $ _____ (Add/Deduct)

SCHEDULE:
The undersigned if awarded a Contract, agrees to work concurrently with the work of other Trade Contractors and the Construction Manager, according to the "Approved Construction Schedule."

BIDDER'S CERTIFICATE:

I hereby certify that all statements herein are made on behalf of

_____
(Name of Corporation, Partnership or Person Submitting a Bid)

A Corporation organized and existing under the laws of the State of _____

_____
Bidder's Name

TRADE CONTRACT PROPOSAL FORM

WORK CATEGORY NO. 00 and _____ Date: _____

An individual doing business as _____

Signature:
Title:
Address:

Phone:
Fax:
Email:

SUBCONTRACTOR PAYMENT BOND

BOND NUMBER: _____

SUBCONTRACTOR: _____
Address: _____

SURETY: (or Sureties) _____
Address: _____
Phone Number: _____
Email: _____

CONTRACTOR: **THE CHRISTMAN COMPANY**
Address: 208 N. Capitol Avenue, Lansing, MI 48933

PROJECT: _____

SUBCONTRACT DATE: _____

CONTRACT AMOUNT: $ _____

BOND AMOUNT: _____ Dollars
($)

Contractor has entered into a Subcontract or Purchase Order (Agreement) with Subcontractor in the amount stated above (Contract Amount) for the Project for the performance of work, including warranty obligations (Work), as detailed in the Agreement. That Agreement is incorporated by reference in its entirety into this Bond.

By virtue of this Bond, Subcontractor and Surety are held and firmly bound to Contractor to pay for labor, materials, and equipment (collectively, "Improvements") furnished for use in performing the Work and agree to bind themselves and their respective heirs, administrators, executors, successors and permitted assigns, jointly and severally, firmly as follows:

1. **Payment Made** If Subcontractor promptly pays all sums due Claimants and defends, indemnifies and holds harmless Contractor from claims, demands, liens or suits by any person or entity seeking payment for Improvements furnished for use in performing the Work, then Subcontractor and Surety shall have no obligation under the Bond.

2. **Surety Obligation to Contractor** Surety's obligations to Contractor shall arise after Contractor notifies Surety and Subcontractor in writing of claims, demands, liens or suits against Contractor or the real property upon which the Project is located, by any person or entity seeking payment for Improvements. Upon such notice, Surety shall promptly, and at Surety's expense, defend, indemnify and hold Contractor harmless from such claim, demand, lien or suit.

3. **Surety Obligation to Claimant** Every Claimant who has not been paid in full before the expiration of ninety (90) days after Claimant provided or performed the last of the Work, or furnished the last of the Improvements for which the claim is made, may have a right of action on this Bond. The Surety's obligation shall not exceed the Bond Sum, as modified.

4. **Limitation of Action** Claimant shall not commence any suit or action on this Bond:

   a. Unless Claimant, except a Claimant having a direct contract with Subcontractor, shall have given written notice of non-payment to Subcontractor, Contractor and Surety within ninety (90) days after Claimant last performed or furnished the Improvements for which the claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom Claimant provided the Improvements. Claimant shall serve such notice to the addresses set forth in this Bond. And, after the expiration of one (1) year from the date when Claimant last performed or provided Improvements to the Project. If this provision is prohibited by law, the minimum period of limitation available to surety in the jurisdiction shall apply; and,
   b. Other than in any court of competent jurisdiction in the location where the Project is located.

5. **Contractor Notice** Contractor's written notice to Subcontractor and Surety of Claimant's claim, served by Contractor to the addresses set forth in this Bond, shall be sufficient to satisfy Claimant's obligation in paragraph 4(a) to furnish notice. Contractor's notice in the form of email with delivery or read-receipt verification shall be sufficient written notice. Notwithstanding the foregoing, Contractor shall have no affirmative obligation to Claimant, Subcontractor or Surety to provide notice on behalf of Claimant.

SUBCONTRACTOR PAYMENT BOND

BOND NUMBER: _____

6. **Surety Response** When the conditions of paragraph 4(a) are satisfied, Surety shall promptly, and at Surety's expense, take the following actions:

   a. Provide a written response to Claimant, with a copy to Subcontractor, within forty-five (45) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and,
   b. Pay any undisputed amounts.

7. **Claimant** Claimant means an individual or entity having a direct contract with Subcontractor, or with a subcontractor or vendor of the Subcontractor, to provide Improvements. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located.

8. **Improvements** The intent of this Bond shall be to include, without limitation, in the terms "Improvements" and "labor, materials, or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in performing the Work, architectural, engineering, and consulting services required for the work of the Subcontractor and the Subcontractor's subcontractors, and all other items for which a mechanic's lien may be asserted.

9. **Principal Surety** Surety is the principal surety and its obligations under this Bond shall be deemed primary to any bond procured by Contractor, with Contractor's surety being deemed a sub-surety.

10. **Changes** Surety agrees that no change, extension of time, alteration, addition, deletion, amendment, or other modification of the Agreement or the Prime Contract between Contractor and the Project owner, or both, or in the Work, specifications, drawings, whether material or otherwise, or in the manner, time or amount of payment as provided therein, and whether or not made in the manner as provided therein, shall in any way affect Surety's obligations on this Bond, except that the Bond Sum shall increase directly with any additive amendments to the Agreement. Surety hereby waives notice of any changes, extensions of time, alterations, additions, deletions, amendments, and other modifications to the Agreement.

Subcontractor and Surety cause this Bond to be duly executed and acknowledged as set forth below, on this day of _____.

SUBCONTRACTOR
Company:

_____
By:
Its:

SURETY
Company:

_____
By:
Its: Attorney in Fact

(Impress Corporate Seal)

SUBCONTRACTOR PERFORMANCE BOND

BOND NUMBER: _____

SUBCONTRACTOR: _____
Address: _____
As Principal (the Principal), and

SURETY: (or Sureties) _____
Address: _____
Phone Number: _____
Email: _____
As Surety or Co-Sureties (collectively, Surety), and

CONTRACTOR: **THE CHRISTMAN COMPANY**
Address: 208 N. Capitol Avenue, Lansing, MI 48933
As Obligee (Obligee)

PROJECT: _____

SUBCONTRACT DATE: _____

CONTRACT AMOUNT: $ _____

BOND AMOUNT (Penal Sum): Dollars _____
($)

WHEREAS, Principal has by written agreement entered into a Subcontract Agreement or Purchase Order (Agreement) with Obligee in the amount stated above (Contract Amount) for the performance of work, including warranty obligations (Work), as detailed in the Agreement, which Agreement in its entirety is by reference expressly incorporated into this Bond.

WHEREAS, the amount of this Bond (Penal Sum) is in the amount stated above.

NOW THEREFORE, Principal and Surety are held and firmly bound to Obligee for the payment of the Penal Sum and agree to bind themselves and their respective heirs, administrators, executors, successors and permitted assigns, jointly and severally, firmly as follows:

1. If Principal shall promptly and faithfully perform the Agreement within the time provided therein, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

2. Surety agrees that no change, extension of time, alteration, addition, deletion, amendment, or other modification of the Agreement or the Prime Contract between Obligee and the Project owner, or both, or in the Work, specifications, drawings, whether material or otherwise, or in the manner, time or amount of payment as provided therein, and whether or not made in the manner as provided therein, shall in any way affect Surety's obligations on this Bond, except that the Penal Sum of this Bond shall increase directly with any additive amendments to the Agreement provided the additive change(s) do not, either singly or in the aggregate, exceed 20% of the original Contract Amount. If any change singly or in the aggregate exceeds 20% of the original Contract Amount, Obligee shall obtain Surety's written consent to increase the Penal Sum. Surety hereby waives notice of any changes, extensions of time, alterations, additions, deletions, amendments, and other modifications to the Agreement.

3. Whenever Obligee has declared Principal to be in default of the Agreement, Surety shall, within twenty (20) calendar days of receipt of Obligee's declaration of default (Investigation Period), respond as follows, failure of

which shall be a material breach of this Bond:

a. Determine the amount for which Surety may be liable and tender the amount to Obligee; or,

b. Notify Obligee that Surety has elected to complete the Work itself or through its agents or contractors in accordance with the terms and conditions of the Agreement, in a manner acceptable to Obligee, and thereafter promptly begin the Work; or,

c. Obtain bids or offers from replacement subcontractors (Completing Subcontractor), reasonably acceptable to Obligee, to complete the Agreement in accordance with its terms and conditions, and upon determination by Surety and Obligee jointly of the lowest responsible bidder or offeror, arrange for new performance and payment bonds from the Completing Subcontractor in a form and from a surety as required by the Agreement, all of which must be completed before expiration of the Investigation Period. Upon execution of the agreement between Completing Contractor and Obligee, Surety shall pay to Obligee, within five (5) days of execution, the difference between the cost to complete the Work and the Contract Balance; or,

d. Arrange to provide financial and/or other assistance to the Principal (Financing) to assist the Principal with timely completion of the Agreement. This option is subject to Obligee's concurrence, which concurrence may be withheld in Obligee's sole discretion.

e. Having made an independent assessment of the facts and circumstances of Obligee's declaration of default, deny Surety's liability in whole or in part and provide a detailed explanation of the reasons for its denial, specifying amounts that are disputed and undisputed. Surety shall tender payment of any undisputed amount.

4. Surety may request an extension of up to twenty (20) calendar days (Extension Period) to respond as required by the Bond. Surety shall finance performance of the Work during the Extension Period on a schedule and in a manner acceptable to Obligee. Upon expiration of the Extension Period, Surety shall respond as outlined in paragraph 3.

5. Upon declaration that Principal is in default, Obligee shall have the right, but not the obligation, to immediately proceed to perform or correct the Work and take such other action pursuant to its rights under the Agreement to mitigate the damages caused by Principal's default (Mitigation Work). Obligee's overhead (both field and home office) and profit shall be included in the cost of the Mitigation Work at a markup of 20% to the actual labor, material, equipment, and subcontractor costs Obligee incurs. Obligee shall keep Surety reasonably informed of costs incurred for the Mitigation Work. Obligee shall be entitled to deduct the cost of the Mitigation Work from the Contract Balance. To the extent Obligee's cost of the Mitigation Work exceeds the Contract Balance, Surety shall, as the Work progresses, promptly and without deduction, reimburse Obligee for such shortage. Reimbursement by Surety shall reduce the Penal Sum by the amount of Surety's reimbursement to Obligee.

6. The term Contract Balance means the Contract Amount, as adjusted by any amendments to the Agreement issued before declaration of default, less the amount paid by Obligee to Principal or others in accordance with the Agreement, less amounts to which Obligee is entitled to a setoff under the Agreement, and less any other amounts for which the Principal or Surety is liable under the Bond or Agreement.

7. Surety shall be liable for:

a. Principal's responsibilities for correcting defective work, warranty work, latent defects, indemnity, and completion of the Work.

b. Legal, design professional and delay costs resulting or arising from Principal's default, or resulting or arising from the actions or failure to act of the Surety under paragraph 3 herein,

SUBCONTRACTOR PERFORMANCE BOND

BOND NUMBER: _____

and liquidated damages, or if no liquidated damages are specified in the Agreement, and actual damages caused by delayed performance or non-performance of the Principal.

c. Principal's responsibilities for damages and set-offs in accordance with the Agreement.

8. If Surety elects to act under paragraph 3, Surety's liability is limited to Penal Sum, as adjusted pursuant to paragraph 2 above. Notwithstanding the foregoing, Surety shall reimburse Obligee for Obligee's reasonable attorney fees and costs, which shall not be credited against the Penal Sum, from disputes arising from this Bond.

9. Neither Surety's payments for Work performed before Obligee's declaration of default, nor Surety's payments to Claimants as defined in any payment bond issued by Surety as a companion payment bond to this Bond, shall be credited against the Penal Sum of this Bond.

10. All Information Obligee provides to Surety, whether before or after Surety issues the Bond, is provided by Obligee voluntarily as a matter of courtesy and is merely an expression of opinion. Furnishing such information is not a guaranty or warranty of the accuracy or correctness and no responsibility or liability is assumed by Obligee as a result of providing such information to Surety. Surety shall not rely on such information in any manner and waives and releases Obligee and Obligee's surety from any such claims.

11. Surety shall not be liable to Obligee for obligations of the Principal that are unrelated to the Agreement.

12. If this Bond has been furnished to comply with a statutory requirement in the location of the Project, any provision in this Bond conflicting with the statutory requirement shall be deemed deleted and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

13. No right or action shall accrue on this Bond to or for the use of any person or corporation other than Obligee or its heirs, executors, administrators, assigns or successors.

Principal and Surety cause this Bond to be duly executed and acknowledged as set forth below, on this day of _____.

SUBCONTRACTOR AS PRINCIPAL	**SURETY**
Company:	Company:
_____	_____
By:	By:
Its:	Its: Attorney in Fact

(Impress Corporate Seal)

AFFIDAVIT OF BIDDER

The undersigned, the owner or authorized officer of _____(the "Bidder), pursuant to the familial disclosure requirement provided in the _____(the "School District") advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of _____and any member of the Board of Education of the School District or the Superintendent of the School District.

List any Familial Relationships:

BIDDER:

_____

By: _____

Its: _____

STATE OF MICHIGAN)
)ss.
COUNTY OF _____)

This instrument was acknowledged before me on the _____ day of _____, 20___, by

_____.

_____

, Notary Public

_____ County, Michigan

My Commission Expires: _____

Acting in the County of: _____

AFFIDAVIT OF BIDDER

The undersigned, the owner or authorized officer of _____(the "Bidder), pursuant to the familial disclosure requirement provided in the _____(the "School District") advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of Kingscott Architects and or The Christman Company .

List any Familial Relationships:

BIDDER:

_____

By: _____

Its: _____

STATE OF MICHIGAN)
)ss.
COUNTY OF _____)

This instrument was acknowledged before me on the _____ day of _____, 20___, by

_____.

_____

, Notary Public

_____ County, Michigan

My Commission Expires: _____

Acting in the County of: _____

NON-DISCRIMINATION IN EMPLOYMENT CERTIFICATION

Lansing School District
Certificate of Intent to Comply with
"NON-DISCRIMINATION IN EMPLOYMENT" POLICY

I have read Lansing School District's Policy #3310, including paragraph #13 and hereby state my intent to comply with the terms and conditions contained therein. Further I agree to furnish the Michigan Civil Rights Commission with such data and records concerning employment as may be requested by that agency in determining compliance with the policy.

Print or type name of Contact Person:

Signed: _____

_____

Title: _____

Company: _____

Date: _____

AFFIDAVIT OF BIDDER - NON-COLLUSION

Lansing School District
AFFIDAVIT OF BIDDER
SWORN STATEMENT
"Non-Collusion"

DATE: _____

The Bidder, by its officers and agents or representatives, present at the time of filing this bid, being duly sworn, on their oaths, say that neither they nor any of them, have in any way, directly or indirectly, entered into any arrangement or agreement with any other Bidder, whereby such affiant or affiants or either of them has paid or is to pay to such other Bidder any sum of money, or has given, or is to give, to such other Bidder anything of value whatever, or such affiant or affiants or either of them has not, directly or indirectly, entered into any arrangement or agreement with any other Bidder or Bidders, which tends to or does lessen or destroy free competition in the letting of the Contract sought for by the attached bids; that no inducement of any form or character other than that which appears upon the face of the bid, will be suggested, offered, paid or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the Contract, nor has this Bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the Contract sought by this bid.

IN TESTIMONY WHEREOF, the Bidder (an authorized individual) has agrees to the above:

_____
(Company Name)

By: _____
(Authorized Signer)

_____
Print or type Name and Title of Signer

Address:_____

Notary Public:_____

Subscribed and sworn to before me on this _____ day of _____, 2016

County of:_____ My Commission expires: _____

Telephone number: _____

IRAN ECONOMIC SANCTIONS ACT CERTIFICATE

In accordance with the Iran Economic Sanctions Act, Michigan 2012 PA 517, effective April 1, 2013, (MCL 129.311, *et seq.*), (the "Act"), the undersigned certifies in support of its bid or proposal that it is not an Iran linked business as such is defined in the Act.

Contractor:_____

By:_____

Dated: _____

Name:_____

Title:_____

Act No. 517
Public Acts of 2012
Approved by the Governor
December 28, 2012
Filed with the Secretary of State
December 28, 2012
EFFECTIVE DATE: April 1, 2013

STATE OF MICHIGAN
96TH LEGISLATURE
REGULAR SESSION OF 2012

Introduced by Senators Kahn, Marleau, Brandenburg, Anderson, Green and Booher

ENROLLED SENATE BILL No. 1024

AN ACT to prohibit persons who have certain economic relationships with Iran from submitting bids on requests for proposals with this state, political subdivisions of this state, and other public entities; to require bidders for certain public contracts to submit certification of eligibility with the bid; to require reports; and to provide for sanctions for false certification.

The People of the State of Michigan enact:

Sec. 1. This act shall be known and may be cited as the "Iran economic sanctions act".

Sec. 2. As used in this act:

(a) "Energy sector of Iran" means activities to develop petroleum or natural gas resources or nuclear power in Iran.

(b) "Investment" means 1 or more of the following:

(*i*) A commitment or contribution of funds or property.

(*ii*) A loan or other extension of credit.

(*iii*) The entry into or renewal of a contract for goods or services.

(c) "Investment activity" means 1 or more of the following:

(*i*) A person who has an investment of $20,000,000.00 or more in the energy sector of Iran.

(*ii*) A financial institution that extends $20,000,000.00 or more in credit to another person, for 45 days or more, if that person will use the credit for investment in the energy sector of Iran.

(d) "Iran" means any agency or instrumentality of Iran.

(e) "Iran linked business" means either of the following:

(*i*) A person engaging in investment activities in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers or products used to construct or maintain pipelines used to transport oil or liquefied natural gas for the energy sector of Iran.

(*ii*) A financial institution that extends credit to another person, if that person will use the credit to engage in investment activities in the energy sector of Iran.

(f) "Person" means any of the following:

(*i*) An individual, corporation, company, limited liability company, business association, partnership, society, trust, or any other nongovernmental entity, organization, or group.

(*ii*) Any governmental entity or instrumentality of a government, including a multilateral development institution, as defined in section 1701(c)(3) of the international financial institutional act, 22 USC 262r(c)(3).

(*iii*) Any successor, subunit, parent company, or subsidiary of, or company under common ownership or control with, any entity described in subparagraph (*i*) or (*ii*).

(g) "Public entity" means this state or an agency or authority of this state, school district, community college district, intermediate school district, city, village, township, county, public authority, or public airport authority.

Sec. 3. (1) Beginning April 1, 2013, an Iran linked business is not eligible to submit a bid on a request for proposal with a public entity.

(2) Beginning April 1, 2013, a public entity shall require a person that submits a bid on a request for proposal with the public entity to certify that it is not an Iran linked business.

Sec. 4. If a public entity determines, using credible information available to the public, that a person has submitted a false certification under section 3(2), the public entity shall provide the person with written notice of its determination and of the intent not to enter into or renew a contract with the person. The notice shall include information on how to contest the determination and specify that the person may become eligible for a future contract with the public entity if the person ceases the activities that cause it to be an Iran linked business. The person shall have 90 days following receipt of the notice to respond in writing and to demonstrate that the determination of false certification was made in error. If a person does not make that demonstration within 90 days after receipt of the notice, the public entity may terminate any existing contract and shall report the name of the person to the attorney general together with information supporting the determination.

Sec. 5. The attorney general may bring a civil action against any person reported under section 4. If a civil action results in a finding that the person submitted a false certification, the person is responsible for a civil penalty of not more than $250,000.00 or 2 times the amount of the contract or proposed contract for which the false certification was made, whichever is greater, the cost of the public entity's investigation, and reasonable attorney fees, in addition to the fine. A person who submitted a false certification shall be ineligible to bid on a request for proposal for 3 years from the date the public entity determines that the person has submitted the false certification.

Sec. 6. The provisions of this act are effective only if Iran is a state sponsor of terror as defined under section 2 of the divestment from terror act, 2008 PA 234, MCL 129.292.

Enacting section 1. This act takes effect April 1, 2013.

This act is ordered to take immediate effect.

Carol Morey Viventi

Secretary of the Senate

Gary E Randall

Clerk of the House of Representatives

LEGAL STATUS OF BIDDER

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS. The Vendor and/or Bidder certifies to the best of its knowledge and belief that it and its principals: Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency; Have not within a three-year period preceding this agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property; Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offences enumerated above in this certification; and Have not within a three-year period preceding this agreement had one or more public transactions (Federal, State, or local) terminated for cause or default; is not now or has been, within a three-year period preceding this date, been listed on the Excluded Parties List System website (EPLS).

Vendor/contractor will notify the Lansing School District Purchasing Office immediately upon becoming suspended or debarred if there is any current or ongoing contract or agreement in place between the district and the vendor/contractor.

Firm Name: _____

Address: _____

Phone & E-mail: _____

Name, title and signature of individual duly authorized to execute contracts:

The Owner, Principal, or Corporate Office of the responding firm is also attesting that all the information provided within this response is true.

Name: _____

Title: _____

Signature: _____

A Corporation organized and existing under the laws of the

State of ____

DATE: Monday, February 19, 2024

PROJECT: Willow School

OWNER: Lansing School District

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

Attached project specific version of AIA A201-2017 as modified. All references to the “Standard form of General Conditions” are hereinafter in these specifications shall refer to the above documents.

END OF SECTION

CHRISTMAN
SINCE 1894

Trade Contractor Guarantee

Project: Willow School
Job No.: 221125-090
Owner: Lansing School District
A/E: Kingscott
Date: _____

Trade Contractor:

Work Category No.:

Description:

We, the undersigned, hereby guarantee that all work accomplished and materials provided under the above-named contract or subcontract is in accordance with the terms of the contract documents as prepared by The Christman Company and the Architect/Engineer, including all addenda, change orders, and clarifications issued.

All work under the above-named contract or subcontract shall be guaranteed against defective material and workmanship for a period of **two (2)** years after **(SUBSTANTIAL COMPLETION DATE)**; correction of any deficiencies or defective work developing during this period shall be undertaken within three (3) working days following the receipt of notice by The Christman Company or Owner; and such work shall be made good by this trade contractor or sub-trade contractor at his own expense.

The following extended guarantees are a part of this contract or subcontract and shall be guaranteed as specifically described in the contract documents and as follows, but not limited to:

Trade Contractor: _____
By: _____
Signature: _____
Address: _____
_____
Telephone: _____
Fax: _____

CHRISTMAN
SINCE 1894

Job No. **Work Category:**

** SUBCONTRACT **

This Subcontract (Agreement) is dated , between , , with its principal place of business at 208 N. Capitol Avenue, Lansing, MI 48933-1357 (Christman), and , with its principal place of business at , (Subcontractor). Christman and Subcontractor are collectively called the Parties. The Parties agree:

ARTICLE 1 - PROJECT

Subcontractor shall perform and pay for all of the Work, for the Contract Sum on the following Project known as , located at , , , , for (Owner) in accordance with the documents prepared by (Architect/Engineer).

ARTICLE 2 - CONTRACT SUM

2.1 Contract Sum Subcontractor shall perform the Work for the Contract Sum, subject to adjustment only with Christman's prior written approval for changes in the Work. For the complete, timely, and satisfactory performance of the Work, Christman will pay Subcontractor the Contract Sum, subject to additions or deletions by Change Order, and subject to the terms of the Contract Documents. The Contract Sum shall not be adjusted unless Subcontractor shall have strictly complied with Articles 13 (Changes). Notwithstanding the foregoing, Christman may adjust the Contract Sum by Change Order, without Subcontractor's consent, for backcharges, set offs, or all costs associated with Subcontractor's Default. Subcontractor shall pay for all costs to perform its obligations, even if those costs exceed the Contract Sum.

Sample

Contract Sum: * DOLLARS*****

. Work Category

Total for Subcontract:

2.2 Resource Planning The Contract Sum shall include any material or labor escalation, incidental costs required for the Project, any additional crews, overtime, shift time, and any other resource necessary to meet the Project Schedule, including any revisions or amendments to the Schedule.

2.3 Employer Contributions & Taxes The Contract Sum shall include: (a) all wages, prevailing wages (if required), premiums, payroll taxes, pension, fringe, welfare, vacation, annuity, travel pay, and union or benefit contributions, apprenticeship or industry advancement funds payable in connection with the Work if applicable or as required by Applicable Laws (collectively, Employer Contributions); and (b) all taxes arising out of Subcontractor's furnishing or installing any labor, material and equipment including but not limited to sales, use, personal property, and excise taxes (collectively, Taxes). Before receiving final payment, Subcontractor shall certify that it has paid all Employer Contributions and Taxes.

2.4 Patents & Copyrights The Contract Sum shall include all license fees and royalties for all items, materials, methods, or systems for the Work provided by subcontractor.

2.5 Lump Sum This is a lump sum contract. Subcontractor represents and warrants that it has independently investigated and ascertained the quantity and cost of the Work. The Contract Sum shall not be adjusted for increases in the quantity or cost of labor or materials. Subcontractor assumes exclusive liability for all matters required to be included in the Contract Sum.

ARTICLE 3 - WORK

3.1 The Work Subcontractor shall provide and install all labor, materials, tools, equipment, hoisting, scaffolding, insurance, Taxes, supervision, services, design, and all other items, in the quantities necessary to properly, efficiently and timely prosecute and

complete the Work identified in the Contract Documents and Supplements, except to the extent specifically indicated in the Contract Documents to be the responsibility of another trade (the Work). The Drawings and Specifications describe the general scope of the Project, and as such, they do not necessarily describe all work required for the full performance of the Work. The Parties execute this Agreement on the basis of such documents with the understanding that Subcontractor shall furnish and install all items reasonably implied or inferable by Christman or the Owner from the Contract Documents as required for the proper completion of the Work without adjustment to the Contract Sum. Subcontractor shall perform the Work in strict accordance with the Contract Documents. All workmanship shall be of the highest grade. All materials and equipment shall be new except as provided in the Contract Documents.

ARTICLE 4 - CONTRACT DOCUMENTS

4.1 Contract Documents Subcontractor, and its subcontractors, consultants, laborers and suppliers (collectively, Lower Tiers), shall be bound by the Contract Documents which consist of this Agreement, Exhibits to this Agreement, the agreement between Christman and Owner/Customer (Prime Contract) except as otherwise provided in this Agreement, all documents incorporated in the Prime Contract, the Drawings, Specifications, Addenda, Conditions, and any documents set forth in Supplements, all of which are incorporated herein and made a part of this Agreement, except payment terms of the Prime Contract and except dispute resolution terms of the Prime Contract as they relate to the specific method of final dispute resolution after claim submission, in which case Article 16 (Dispute Resolution) controls. Subcontractor shall perform all Work subject to all terms and conditions, express or implied, in the Contract Documents relating to its Work, it being the intention that Subcontractor will fully, properly and faithfully discharge the obligations of Christman insofar as the Subcontractor's Work.

4.2 Flow Down Subcontractor assumes toward Christman all of the obligations and responsibilities that Christman, by the Contract Documents, assumes toward Owner insofar as the Subcontractor's Work, regardless of whether Owner enforces these obligations against Christman. Subcontractor shall not have any right or remedy against Christman which Christman does not have to or against the Owner under the Contract Documents. Subcontractor shall incorporate the Contract Documents by reference into any agreements with Lower Tiers. By written contract, Subcontractor shall require its Lower Tiers to assume towards Subcontractor and Christman all of the obligations including but not limited to, insurance, indemnity, and defense that Subcontractor, by the Contract Documents, assumes toward Christman insofar as the Subcontractor's Work. If requested by Subcontractor, Christman shall supply Subcontractor with a copy of the Prime Contract with confidential information redacted.

Sample

4.3 Conflicts & Interpretation The Contract Documents are intended to complement each other and shall be so interpreted where possible. If, however, any provision of this Agreement irreconcilably conflicts with another provision of the Contract Documents, the provision imposing the greater duty, greater quality, or more stringent requirement on Subcontractor shall govern. Further, to the extent the Contract Documents give the Architect/Engineer or Owner the right to determine quantities, quality, and other factors relating to the Work, such determinations shall be binding on Subcontractor to the same extent they are binding on Christman.

4.4 Acceptance Subcontractor's signature on this Agreement or the start of any Work shall constitute Subcontractor's acceptance of this Agreement. However, this Agreement is expressly contingent upon Owner approving Subcontractor. Upon Christman's notice to Subcontractor that Owner rejects Subcontractor, Subcontractor shall have 5 days after notice to overcome its disqualification to the satisfaction of Owner, otherwise this Agreement shall be deemed null and void.

ARTICLE 5 - BONDS

5.1 Surety Qualification If Performance and/or Payment bonds are required, Subcontractor shall pay for and deliver such bonds, within 10 days of Christman's request using the form specified by Christman and attached to this Agreement, each in the full amount of this Agreement, issued by a United States (U.S.) Treasury listed surety with an AM Best rating of A or better, approved and licensed to do business in the state where the Project is located (Controlling State), duly executed by agents with complete Power of Attorney to the full limits therein. Christman shall have the right, in its discretion, to reject Subcontractor's bonds and surety and to require replacement of the bonds and/or surety, at Subcontractor's cost, if the surety proposed by Subcontractor does not meet any requirements of this Agreement upon submission. Subcontractor is not permitted any mark up on bond costs and shall present an invoice from its surety to establish the actual cost of any bonds. Subcontractor shall refund to Christman any rebate or refund in bond premiums resulting from adjustment in bonds.

5.2 Changes & Terms Christman shall have the right, without notice to Subcontractor's surety, to order changes in the performance or time of performance of the Work and to modify this Agreement. No extension of time, change, addition, or omission of terms in this Agreement or the Prime Contract shall affect the surety's obligation on the bonds. Subcontractor and its surety waive notice to the surety of any such extension of time, change, addition, or omission. Subcontractor and surety agree without the necessity for any further authorization, to increase the bonds' penal sums if or when additive changes to the Contract Sum are executed. Christman's response to any surety inquiry as to Subcontractor's performance shall not estop or impair Christman's rights under this Agreement or any bond, and surety shall be required to conduct its own independent investigation of Subcontractor's performance.

5.3 Duration Any Performance Bond shall guaranty Subcontractor's performance through the end of any warranty period and any statute of limitation as to surety's obligations under the Performance Bond shall not begin to accrue until the warranty period ends, subject to the requirements of the Prime Contract and as allowable by Applicable Law.

ARTICLE 6 - INSURANCE

6.1 General Obligation Before starting any Work and as a condition precedent to payment, Subcontractor shall maintain insurance in the types, coverages, and for the limits as set forth below, in the Prime Contract, or in Subcontractor's actual policies of insurance, *whichever is greater or requires more*, and shall furnish Certificates of Insurance (COI) evidencing such insurance.

a. Worker's Compensation — Statutory Limit | $1,000,000 Employer's Liability

b. Commercial General Liability (CGL)*
   1) Bodily Injury — $2,000,000 Each Occurrence | $2,000,000 Per Project Aggregate
   2) Property Damage — $2,000,000 Each Occurrence | $2,000,000 Per Project Aggregate

   Subcontracts greater than $3,000,000
   1) Bodily Injury — $5,000,000 Each Occurrence | $5,000,000 Per Project Aggregate
   2) Property Damage — $5,000,000 Each Occurrence | $5,000,000 Per Project Aggregate

   *Coverage shall be occurrence based and shall include products and completed operations, contractual and independent contractors, and where applicable, underground hazard and/or explosion and collapse

c. Comprehensive Automobile Liability
   1) Bodily Injury — $2,000,000 Each Occurrence | $2,000,000 Per Project Aggregate
   2) Property Damage — $2,000,000 Each Occurrence

d. Professional Liability - when the Work includes any design, engineering, or professional services with a deductible and/or self-insured retention, including those relating to defense costs, not in excess of $25,000
   $2,000,000 Each Occurrence | $2,000,000 Per Project Aggregate

Insurance policy limits shall be in the amounts specified above, as required by the Prime Contract, or as specified in Subcontractor's policies, *whichever is greater*. Policy limits may be achieved through a combination of underlying and excess (umbrella) coverage. Unless the Prime Contract provides for insurance by and at the expense of Owner to protect Subcontractor against loss, Subcontractor shall provide for all of its own insurance of every kind.

6.2 Additional Insured Subcontractor shall name the Owner, Architect/Engineer, Christman, and their directors, officers and agents, and any other persons or entities listed in the Prime Contract and Supplements, as additional insureds (AI) on every policy of insurance, except Workers Compensation, including under the completed operations coverage, using AI ISO form Endorsements CG 20 10 07 04 and CG 20 37 07 04, and with respect to the Architect/Engineer, CG 20 32 07 04. All COIs shall include evidence of these endorsements. Insurance covering the AI parties shall be primary and all other insurance carried by any additional insured shall be excess.

Sample

6.3 Qualifications Subcontractor shall provide insurance from insurers with policy holder ratings not lower than "A" and financial ratings not lower than "XI" in the Best's Insurance Guide, latest edition in effect as of the date of the Agreement.

6.4 Duration Subcontractor warrants and represents that for the duration of its Work, and for such longer periods required herein, Subcontractor has and shall maintain the required insurance coverage. Subcontractor shall maintain Products and Completed Operations insurance for a minimum period of the longer of the following: (a) six years after the Project Substantial Completion Date; or (b) the period of the statute of limitation or the statute of repose of the Controlling State; or (c) the duration set forth in the Prime Contract.

6.5 Cancellation Subcontractor shall provide written notice to Christman of the cancellation or expiration of any required insurance within 3 days of the date of the cancellation or expiration or within 3 days Subcontractor is first aware of any notice of cancellation or expiration, whichever comes first. If Subcontractor becomes uninsured, such event shall be deemed a material breach of contract and an immediate Subcontractor Default without notice.

6.6 Subcontractor Property If any loss or damage to Subcontractor's own property occurs, Subcontractor shall look solely to its own insurance for recovery regardless of whether a Builder's Risk policy is in place on the project, and is solely responsible for its deductibles. Subcontractor shall hold harmless and defend Christman and Owner from such loss or damage.

6.7 Deductibles Subcontractor shall be solely and exclusively responsible for any insurance deductibles to the extent arising out of or relating in any way to its Work, including but not limited to claims which could be covered by Builder's Risk insurance.

6.8 Waiver of Subrogation Subcontractor unconditionally waives all of its rights and shall require its insurers and Lower Tiers to unconditionally waive all rights of subrogation against the Owner, Architect/Engineer, Christman, and their parent companies, affiliates, subsidiaries, partners, officers, directors, employees, and agents, and similarly waives all rights of subrogation against all other subcontractors, vendors and suppliers.

Sample

6.9 Vertical Exhaustion Subcontractor's underlying and excess coverage shall be primary and noncontributory to any policy of insurance maintained by any other entity and shall be vertically exhausted first in the order of coverage before any other policy of insurance. Subcontractor's excess policy shall be tied only to Subcontractor's underlying policy and shall not require the exhaustion of limits of policies of any insurance maintained by any other entity before attaching. Further, Subcontractor's excess policy shall not require the exhaustion of underlying limits only through the actual payment by the underlying insurer.

6.10 Lower Tiers Subcontractor shall require, and Subcontractor represents that its Lower Tiers will maintain, the insurance coverages specified in this Article including naming Owner, Architect/Engineer, and Christman, as additional insureds.

ARTICLE 7 - INDEMNITY

7.1 TO THE MAXIMUM EXTENT PERMITTED BY LAW, SUBCONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS OWNER, ARCHITECT/ENGINEER, CHRISTMAN, AND THEIR OFFICERS, DIRECTORS, EMPLOYEES, AGENTS AND ASSIGNS, AND OTHER ENTITIES IF ANY, THAT CHRISTMAN IS OBLIGATED TO INDEMNIFY BY THE PRIME CONTRACT, (COLLECTIVELY, INDEMNITEES) FROM AND AGAINST ANY AND ALL CLAIMS, ALLEGATIONS, DEMANDS, DAMAGES, COSTS, EXPENSES, PENALTIES, WORK STOPPAGE, ATTORNEY FEES, AND/OR LIABILITIES OF ANY TYPE OR KIND, REGARDLESS OF THE LEGAL THEORY, ARISING OUT OF OR RELATED TO THE WORK (COLLECTIVELY, CLAIMS) INCLUDING BUT NOT LIMITED TO ANY AND ALL CLAIMS: (a) personal injury or property damage or property impairment; (b) defects or omissions in Subcontractor's workmanship or materials provided; (c) Subcontractor's violation of any Applicable Law, regulatory violations, citations or penalties; (d) Subcontractor's breach or failure to perform this Agreement; (e) Subcontractor's use of Christman's equipment or equipment operator and Christman's use of Subcontractor's equipment in accordance with section 10.4; (f) Subcontractor's infringement of any patent, trademark or other proprietary right; (g) claims and/or liens per Article 12; (h) Subcontractor's breach of any representation or warranty; (i) damage to Subcontractor's own equipment and property; (j) Subcontractor's violation of any applicable confidentiality or nondisclosure agreement; (k) Subcontractor's failure to comply with all matters required to be included in the Contract Sum; (l) Subcontractor

substitutions, regardless of whether Christman or Owner consented to the substitution; and, (m) any claim as described in the Prime Contract. **THIS INDEMNITY OBLIGATION COVERS ALL CLAIMS CAUSED BY OR CONTRIBUTED TO, IN WHOLE OR IN PART, ANY ACTIVITY OR INACTIVITY OF SUBCONTRACTOR, ITS LOWER TIERS, AND THEIR OFFICERS, DIRECTORS, EMPLOYEES, OR AGENTS. THIS INDEMNITY APPLIES REGARDLESS OF ANY ACTIVE AND/OR PASSIVE NEGLIGENT ACT OR OMISSION OF INDEMNITEES. SUBCONTRACTOR, HOWEVER, SHALL NOT BE OBLIGATED TO INDEMNIFY AN INDEMNITEE FOR CLAIMS ARISING FROM THE SOLE NEGLIGENCE OF THAT SPECIFIC INDEMNITEE. THE INDEMNITY OBLIGATIONS SHALL NOT BE LIMITED IN ANY WAY BY ANY LIMITATION ON THE AMOUNT OR TYPE OF DAMAGES, COMPENSATION OR BENEFITS PAYABLE BY OR FOR SUBCONTRACTOR UNDER WORKER'S COMPENSATION ACTS, DISABILITY BENEFIT ACTS OR OTHER EMPLOYEE BENEFIT ACTS..**

7.2 Duty to Defend At its cost and with legal counsel reasonably acceptable to Christman, Subcontractor shall defend Indemnitees from any Claims, including those raised in an administrative hearing, arbitration or similar proceeding. The obligation to defend accrues immediately upon receipt of a notice of Claim. If Subcontractor fails to provide timely, competent defense, Christman shall be entitled to reasonable costs associated with assuming such defense, including but not limited to attorney fees and costs incurred to enforce this indemnity and defense provision.

7.3 Notice to Insurer/Surety Subcontractor shall advise its insurers and sureties of these indemnity, defense, and hold harmless and insurance obligations and shall obtain a contractual coverage endorsement to discharge its obligations as set forth herein.

7.4 Consideration The Parties agree that $1,000 of the Contract Sum is part of the consideration for this indemnity obligation. Only in those states where there must be a contractual limit on indemnity obligations, the contractual limit shall be three times the aggregate value of CGL insurance limits required by this Agreement.

Sample

7.5 Survival Subcontractor's indemnity and defense obligations shall survive the termination or expiration of this Agreement and the completion of the Work.

ARTICLE 8 - SAFETY

8.1 Responsibility Subcontractor represents that it has expertise in the particular means and methods required to safely execute the Work and that it maintains a consistently high level of safety and health compliance. At its expense, Subcontractor shall furnish its workers a place of employment free from recognized hazards that cause or are likely to cause serious physical harm. Subcontractor shall protect from injury, its employees engaged in the Work, employees of other trade contractors working adjacent to Subcontractors Work and all property and persons which may be affected by its operations. The prevention of accidents to workers engaged in the Work and others affected by the Work is the responsibility of Subcontractor. Subcontractor shall strictly comply with the Safety Program of Christman and the Owner, and all Applicable Laws. The Subcontractor shall submit to Christman, a current Safety Program and Experience Modification Rates for Subcontractor and Lower Tiers. Subcontractor shall employ all engineering controls, administrative actions, and personal protective equipment to eliminate, and where elimination is not possible, control and reduce worker exposure to hazardous conditions, including but not limited to respirable crystalline silica and asbestos containing material. Subcontractor shall periodically monitor and evaluate its engineering and work practice controls to ensure they are effective and to discover, prevent and detect hazardous conditions. Subcontractor shall furnish Christman copies of Safety Data Sheets for all materials to be used in executing the Work. Subcontractor's foreman/superintendent (Foreman), at a minimum shall have satisfactorily completed OSHA 10-Hour training. The Foreman shall be assigned for the duration of the Project so as to maintain continuity. The Foreman shall speak English and be able to translate into English for non-English speaking workers to facilitate communications and ensure mutual understanding. Subcontractor shall ensure that all non-English speaking workers fully understand the site safety requirements and their duties for safety, health, and welfare. Subcontractor shall immediately correct any unsafe or hazardous condition related to its Work. If Subcontractor fails to immediately correct an unsafe condition, Christman may have the unsafe condition corrected by others at Subcontractor's expense or direct that the Work be stopped in the area of the unsafe condition.

8.2 Hazardous Materials Christman makes no representation or warranty as to conditions described in any hazardous materials

survey. If Subcontractor encounters any hazardous conditions or materials, Subcontractor shall immediately stop Work in the affected area and notify Christman in writing. Subcontractor acknowledges that it is fully apprised of all Applicable Law regarding hazardous conditions or material and that it will be fully responsible for disturbing any hazardous material, including for any and all fines, penalties, or damages assessed against Subcontractor or Christman. If Subcontractor uses hazardous materials on site of any type for which an employer is required by Applicable Laws to notify its employees of such use Subcontractor shall, before using the materials on site, give timely written notice of the materials to Christman. Subcontractor shall immediately correct any unsafe or hazardous condition related to its Work. If Subcontractor fails to immediately correct an unsafe condition, Christman may have the unsafe condition corrected by others at Subcontractor's expense or direct that the Work be stopped in the area of the unsafe condition.

8.3 Notice Subcontractor shall immediately notify Christman and provide Christman with copies of all OSHA citations and accident reports.

8.4 Responsibility Per Article 7, Subcontractor shall bear sole responsibility for any Claims arising out of any breach of, in whole or in part, or failure to comply with this Article, by the Subcontractor or its Lower Tiers, their invitees, or vendors, including any claims arising from regulatory violations, citations or penalties.

ARTCLE 9 - DESIGN SERVICES (If Applicable)

9.1 Design Services If the Work includes any design, engineering or professional services, Subcontractor accepts the design standards, criteria and performance specifications in the Contract Documents and agrees that such data is sufficient for Subcontractor's proper design and functioning of the Work. Christman does not warrant the accuracy or completeness of information in the Contract Documents, however, Subcontractor may rely on these items to the same extent Christman is entitled to rely upon such items in the Prime Contract. Subcontractor agrees that its design services relate to a part of the overall design of the Project and that its design must integrate into the Project's overall design concept expressed, inferred or reasonably implied by the Contract Documents. Subcontractor shall coordinate its Work with the services performed by others. Subcontractor shall submit to Christman detailed drawings and specifications (Work Product) describing the requirements for the Work and showing the relationship of the Work to the overall Project. Subcontractor shall provide Work Product in the form and quantity required by the Contract Documents. Christman shall be entitled to rely upon the adequacy, accuracy and completeness of the services and certifications or approvals performed by Subcontractor and its Lower Tiers. Subcontractor shall perform agreed upon revisions and submit revised Work Product for Christman's review. Subcontractor shall provide written notice to Christman and other affected trades of all design development changes in sufficient time to preclude additional costs and conflicts with the work of others.

Sample

9.2 Design Consultant Subcontractor's engagement of any design consultant shall be subject to Christman's written approval. The consultant's seal shall appear on all drawings, calculations, specifications, certifications, shop drawings and other Work Product prepared by the consultant. All consultants shall be licensed in accordance with Applicable Laws and fully bound to Christman in the same manner as Subcontractor is bound to Christman for all Contract Document requirements applicable to the Work, including all insurance requirements, including professional liability insurance. Subcontractor shall be responsible for the services performed by its consultants.

9.3 Standard of Care Subcontractor's standard of care for all design services shall be the highest care and skill used by members of the design profession practicing under similar conditions at the same time and locality of the Project, or as stated in the Prime Contract, whichever imposes the higher standard of care.

ARTICLE 10 - EXECUTION OF THE WORK

10.1 Project Investigation Subcontractor assumes responsibility for all Project investigation as related to its Work. Subcontractor represents that it has carefully inspected the Project site. Subcontractor represents that it is familiar with, has satisfied itself as to, and assumes all risk of: (a) the nature, location, and amount of the Work; (b) site conditions and access; (c) ability to perform the Work in accordance with the Project Schedule and Contract Documents; (d) any Applicable Laws and inspection requirements; (e) all safety and barricade requirements; (f) the terms and conditions of applicable collective bargaining agreements, to the extent applicable; (g) the quality, quantity, and availability of labor, materials, equipment, and utilities; and, (h) the limiting physical, climatic, and other conditions. Subcontractor is not relying on any opinion or representation of Christman as to Project conditions.

Subcontractor shall be solely responsible for all cost, expense and damage that may result from Subcontractor's failure to perform or properly perform such investigations including its failure to properly notify Christman and obtain written approval before proceeding with related Work.

10.2 Document Investigation Subcontractor warrants that it has thoroughly reviewed and fully acquainted itself with the Contract Documents and that the Contract Documents are suitable and sufficient for their intended purposes, without any express or implied representation or warranty having been made as to their accuracy, consistency, adequacy, completeness or constructability. Subcontractor shall give written notice to Christman of any error, inconsistency, ambiguity or omission in the Contract Documents within the earlier of 3 days after Subcontractor first becomes aware of the error, or 3 days before the time Christman is required to make such claims to the Owner under the Prime Contract. Subcontractor shall not be excused from any provision of the Contract Documents due to a lack of knowledge or understanding of their content. Christman disclaims any and all warranties, express or implied, as to the accuracy or adequacy of the plans, specifications, design, or other Contract Documents. Subcontractor shall make no claim based upon such disclaimed warranties.

10.3 Qualifications Subcontractor represents and warrants at all times it shall obtain and maintain all necessary credentials, certifications, licenses and other qualifications to do business and safely perform the Work. Subcontractor's obligation to perform the Work is non-delegable and nontransferable. Subcontractor shall be solely responsible for determining, supervising and implementing the means, methods, techniques, sequences, procedures and inspections of its Work. Christman shall not be responsible for the direction, supervision, inspection, quantity or quality of Subcontractor's Work.

10.4 Progress & Cooperation Subcontractor shall furnish sufficient equipment, tools and materials and a sufficient number of properly skilled workers to carry on the Work and conduct its activities in a manner and at a rate of performance in all respects satisfactory to Christman and the Owner and in a manner that will not interfere with, disrupt or delay the activities of Christman, the Owner, or others involved in the Project. Subcontractor shall erect, maintain, inspect and operate all of its equipment including but not limited to scaffolding, hoists, and material handling equipment in accordance with Applicable Laws. Subcontractor shall not unreasonably refuse Christman's use of Subcontractor equipment. If Christman utilizes Subcontractor's equipment, Christman shall not be liable to Subcontractor for the erection, maintenance or inspection of any such equipment, except to the extent Christman has assumed such obligations under written agreement with Subcontractor, and any such use by Christman shall be done in strict accordance with equipment manufacturer's instructions. Any Christman employee engaged in such use has all the necessary and requisite training to operate such equipment. Subcontractor shall cooperate with Christman and others involved in the Project, including those that Subcontractor's schedule may affect, to avoid any conflict and to ensure a first class workmanlike job in every respect. Subcontractor shall maintain good order among its employees and others and not permit upon the Project any disorderly, intemperate, or unfit person or anyone unskilled in performing the Work. At all times Subcontractor shall have a competent person with authority available to act on its behalf. Subcontractor shall provide all technical personnel required to startup, test, commission, and operate any equipment, and to test and use any material, supplies, or other items provided by Subcontractor in connection with the Work and to instruct Christman and Owner's personnel in the operation and maintenance of any equipment, materials, supplies, or other items. Subcontractor shall not perform any work directly for Owner or any Owner tenant or deal directly with the Owner's representatives in connection with the Project.

Sample

10.5 Shop Inspection The Owner, Architect/Engineer, Christman, and their representatives, shall have full access at reasonable hours to Subcontractor's Work and its Lower Tier's shops, factories, or other places of business to inspect the general condition and progress of the Work.

10.6 Submittals Within the time directed by Christman and without delay, Subcontractor shall furnish all mock ups, submittals, shop drawings, product data, specifications, samples, interim design submissions if applicable, electronic data or similar items (Work Product). By submitting such Work Product, Subcontractor represents that it has verified materials, field measurements, and field construction criteria related thereto, or will do so, and has checked and coordinated the information in its Work Product with the requirements of the Contract Documents. If Subcontractor's Work Product is rejected after a reasonable number of reviews, Christman may backcharge Subcontractor for the actual costs to continue review and process the rejected Work Product. Subcontractor waives any claim arising out of Subcontractor's failure to comply with this requirement. Christman's review of Work Product shall be limited to conformance with general design and general detailing and Christman need not verify dimensions or field

conditions. Subcontractor shall not make any substitutions in the Work, unless it first requests in writing permission for a substitution by expressly identifying the item or method substituted, as a "Substitution" and then only upon receipt of Christman's written consent to such substitution. Christman or Owner's review or consent of any Work or Work Product, shall not relieve Subcontractor from its responsibility for any deficiency that may exist or from its obligation to perform the Work in strict accordance with the Contract Documents.

10.7 Layout Subcontractor shall be solely responsible for the layout, accuracy, and workmanship of its Work. Before starting its Work, Subcontractor shall examine the work of others affecting its Work and verify all dimensions set forth in the Contract Documents as they pertain to or may affect Subcontractor's Work. If any defect, conflict, or inconsistency exists, Subcontractor shall immediately notify Christman in writing. Subcontractor shall not proceed until the defect is corrected or Christman provides written authorization to proceed. If Subcontractor fails to inspect or give written notice, Subcontractor shall be deemed to have accepted the work of others as fit and proper to receive Subcontractor's Work and waives any claim as to the defects. Subcontractor is responsible for all corrective work.

10.8 Compliance Subcontractor shall obtain and pay for all necessary permits, licenses, assessments and inspections, and comply with all statutes, ordinances, rules, regulations and orders of any governmental or quasi-governmental authority applicable to the Work (Applicable Laws) including: any LEED building, sustainable construction means, methods or requirements, or energy performance requirements, including those in the Contract Documents; local, state or federal safety and health laws and regulations, including those related to hazardous materials, such as crystalline silica; local, state or federal fair employment practices laws, affirmative action programs, minority contracting programs, business ethics and compliance; rules and regulations of any Contract Compliance Division of the state and federal Civil Rights Commission or any similar commission having jurisdiction; all immigration laws, rules and regulations, including I-9 verification and E-verify; Buy American provisions; and, Davis Bacon and/or state prevailing wage requirements. At Christman's request, Subcontractor shall certify to Christman's satisfaction that its employees have presented the correct documents to legally work in the U.S. Subcontractor shall immediately correct any violations of Applicable Laws.

Sample

10.9 Protecting the Work Subcontractor shall protect all Work, tools, material and equipment against any loss, damage or theft (Loss). At its sole risk, Subcontractor shall bear any Loss to its Work arising from any cause until Substantial Completion as defined in the Prime Contract, or such duration required by the Prime Contract, whichever is greater. Subcontractor is responsible for any Loss to existing property, structures, materials or equipment, the Work, the work of others, and property of Owner and adjacent land owners, utilities, roads, bridges, and waterways, arising out of Subcontractor's operations. Subcontractor shall repair or replace such items to the satisfaction of and at no cost to Christman. If Subcontractor refuses or fails to repair, replace, or correct the Loss, at Christman's sole election, Subcontractor shall accept a deduction in Contract Sum to the extent of the cost incurred by Christman or demanded by Owner. If a dispute arises between Subcontractor and another trade as to which is responsible for any Loss, Christman may determine the responsibility for such Loss and its determination shall be final and binding upon Subcontractor. Christman may backcharge Subcontractor the reasonable actual costs to investigate and respond to such claims.

10.10 Christman Tools & Equipment Subcontractor is responsible for all unloading, moving, lifting, protection, securing, and handling of its materials and equipment at the job site. In consideration of Christman's permission to use any tools or equipment of any nature whatsoever, including but not limited to elevators, hoists, derricks, cranes, side tracks, and yards, Subcontractor contractually assumes complete risk, responsibility, and liability for the use or operation of such equipment, and for any Claim arising in any manner because of Subcontractor's use or operation of tools and equipment or use of same for Subcontractor's benefit, irrespective of who actually operated the tools and equipment.

10.11 Clean Up Subcontractor shall at all times keep the Project and Owner's premises, adjoining premises, and streets clear of rubbish, debris, overspray and similar items resulting from its Work and shall remove all such rubbish at its own expense, as directed by Christman. Subcontractor shall maintain broom clean conditions at the end of each day. Christman shall designate the location of all dumpsters. Subcontractor shall not dispose of any hazardous waste or waste requiring special manifests in these dumpsters. If Subcontractor fails to clean the site to the satisfaction of Christman and/or the Owner upon 24 hours' notice (except where such condition creates a safety concern, and in that case, without notice) then Christman may do so and backcharge Subcontractor the actual cost of cleanup.

10.12 Labor Relations Subcontractor shall only use labor which will not cause disharmony or labor disputes in the performance at the Project. Subcontractor shall implement policies and practices to avoid work stoppages, slowdowns, disputes, and strikes. Subcontractor shall notify Christman promptly of any actual or potential dispute that may affect the Work. Subcontractor guarantees that there shall be no strike, lock-out or other work slowdown affecting its Work or the work of others. Subcontractor represents that it has the legally binding agreement of all bargaining representatives of any part of its workforce (or before beginning Work will obtain such agreement), that the represented workers will not strike, picket, engage in any slow-down or other concerted activity where Work is performed, and will cross and work behind any picket line at the job site, regardless of by whom. If Subcontractor's workers are involved in a dispute with other trades on the Project, or any union, or such workers refuse work due to any labor disputes, Subcontractor shall immediately resolve the disputes. Failure to do so shall be a material breach of this Agreement. If a labor condition threatens the timely completion of any portion of the Work, Christman may, at its option, terminate Subcontractor's right to proceed with Work for Default or employ others to perform the affected Work and backcharge Subcontractor the cost thereof. Notwithstanding the foregoing, Subcontractor shall not be liable for strikes, work stoppages, jurisdictional disputes, lockouts, union and non-union disputes and other similar claims or conflicts ("Labor Issues") except to the extent such Labor Issues are caused, in whole or in part, by the actions or inactions of Subcontractor or anyone else for whom Subcontractor is responsible.

10.13 Meetings Subcontractor shall attend any project meetings as directed by Christman. Subcontractor shall be represented by its Project Manager or Senior Representative responsible for the Project and its Site Supervision. Subcontractor shall attend an on-site pre-installation meeting before beginning any Work. Christman will maintain and distribute to attendees minutes of the meetings for review. Subcontractor shall review the minutes and provide written notice of any objections within 3 days after issuance of the minutes; failure to do so shall be deemed Subcontractor's acceptance without reservation of the content of the minutes.

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10.14 Material Delivery & Installation Space for storage on the Project site may be limited. Subcontractor shall schedule material deliveries accounting for the limited storage or lay down area and to coincide with construction phasing. Subcontractor shall coordinate its access, deliveries, staging, trailers, storage areas and parking in advance, and as approved by Christman's superintendent before Subcontractor's mobilization on site. If Subcontractor's Work includes installation of materials or equipment furnished by others, Subcontractor shall examine the items with due care and install the items with such skill and care as to ensure a satisfactory and proper installation and to preserve all warranties. All material and equipment delivered to the job site or off site and in the process of fabrication shall become the property of the Owner and shall not be removed from the site or damaged in any way.

10.15 Cutting & Patching Unless otherwise directed in writing by Christman, Subcontractor shall do all cutting, fitting, and patching of its Work that may be required to make its several parts come together properly and to fit it to receive or be received by work of others.

10.16 Employment Practices Subcontractor shall not discriminate against any person with respect to his/her hire, tenure, terms, conditions or privileges of employment because of race, color, age, sex, religion, sexual orientation, the presence of a physical, sensory or mental disability, or national origin. Subcontractor shall comply with any and all Applicable Laws as to fair employment practices and other employment programs required by the Contract Documents.

10.17 Conduct Subcontractor and its Lower Tiers shall not engage in any harassment or offensive behavior. Christman strictly prohibits any request to engage in illegal or unethical conduct and negative comments or actions based on race, color, age, sex, religion, sexual orientation, physical, sensory or mental disability, or national origin. Subcontractor shall immediately address any claim of harassment or offensive behavior involving it or its Lower Tiers, properly discipline any person who engaged in such conduct, including removal from the Project where appropriate, and use its best efforts to ensure that such conduct does not reoccur. In its sole judgment, Christman shall have the right to cause removal from the Project any worker who engages in unsafe work practices or violates this Article.

10.18 Recordkeeping Subcontractor shall keep full and detailed accounts and exercise such controls as may be necessary for proper financial management, using accounting and control systems in accordance with generally accepted accounting principles.

During the Work and for a period of 3 years after final payment, Christman and/or Owner and their accountants shall be afforded access to and the right to periodically audit, upon reasonable notice, Subcontractor's records, books, receipts, subcontracts, purchase orders, man hours and equipment hours, and other data relating to the Work, all of which Subcontractor shall preserve for 3 years, or such longer period as specified in the Prime Contract.

10.19 Operation Manuals Upon approval of shop drawings and Submittals, Subcontractor shall provide an electronic copy (unless some other form is specified in the Prime Contract) of Operation and Maintenance Manuals for each item approved, as applicable.

ARTICLE 11 - WARRANTY

11.1 Warranty Subcontractor warrants that the Work shall strictly conform to the requirements of the Contract Documents and shall be free from defects in design, workmanship, and materials. Subcontractor shall promptly correct any defective or nonconforming Work, by (at Christman's exclusive option) adjustment, repair, or replacement to the satisfaction of Christman and Owner. Subcontractor shall pay all costs associated with accessing the Work to make warranty repairs and returning the Work and all affected surrounding work to the condition required by the Contract Documents. If Christman determines that Subcontractor is not timely completing its warranty obligation, Christman may replace or repair, at its sole election, and backcharge Subcontractor all associated costs. If no sums remain due Subcontractor, Subcontractor shall pay Christman all those costs immediately upon demand.

11.2 Duration The Subcontractor shall provide a one (1) year warranty from the actual Project "Substantial Completion Date" on all material, equipment and workmanship, or the warranty duration specified in the Contract Documents, whichever is longer. For any portion of the Work repaired or replaced, Subcontractor shall provide an additional one (1) year, or longer if the Contract Documents require, warranty on the Work after the date of repair or replacement.

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11.3 Statutory Warranty Nothing in this Article shall limit the rights afforded to Christman and Owner under Applicable Law as to Subcontractor's warranty against defects in design, workmanship and materials or defective or non-conforming Work, nor shall this Article limit any statutory period of liability for warranty, design, and latent defects.

ARTICLE 12 - PAYMENT

12.1 Schedule of Values Subcontractor shall submit all payment, insurance and other compliance documents through Christman's Trade Contractor Portal. Within the time required by Christman, Subcontractor shall submit for review, through the Trade Contractor Portal, a detailed schedule of values (SOV) on AIA Form G703 or equivalent. The SOV shall be itemized into discrete items and areas of Work and include labor and material breakdowns for each work item, general conditions, mobilization, demobilization, punch list, and administrative close out, with no less than 5% designated for close out. For any allocation for mobilization, there must be an equal allocation for demobilization. To the extent practicable and subject to Christman's approval, the SOV shall not contain a single line item greater than 5% of the Contract Sum. Christman shall have the right to require modification at any time of the SOV to align with proper allocation of scopes of work and distribution of resources. Christman will not process a payment application until Subcontractor revises or corrects the SOV to account for imbalance, errors or irregularities.

12.2 Conditions To the extent permitted by Applicable Laws, for Subcontractor's complete, timely, and satisfactory performance of the Work, Christman will pay Subcontractor out of such equivalent payment Christman receives from Owner for Subcontractor's Work. Christman will pay Subcontractor within 7 days after Christman receives Owner's payment, less retainage held by Owner or Christman. To the extent permitted by Applicable Laws, Christman's receipt of Owner's payment is an absolute condition precedent to Christman's obligation to pay Subcontractor. If Christman has furnished a payment or performance bond, the obligations of Christman and its surety to make progress payments or final payment is subject to the absolute condition precedent of Owner prior payment. Christman's surety is a third party beneficiary of this condition precedent. Christman's payment to Subcontractor shall not be construed as an admission by Christman of the classification, quantity, quality, or sufficiency of Work done, or as an acceptance or release of Subcontractor's responsibility under this Agreement. Also to the extent permitted by Applicable Law, as an absolute condition precedent to Christman's obligation to pay Subcontractor and using Christman's Trade Contractor Portal, Subcontractor shall timely furnish with each payment request: (a) a satisfactory sworn statement sworn by an officer of Subcontractor; (b) conditional waivers of lien from Subcontractor and its Lower Tiers for the current payment application; (c)

unconditional waivers of lien or bond claims by Subcontractor and its Lower Tiers reflecting Christman's previous payments; (d) payrolls and, if required by the Prime Contract, weekly certified payrolls in compliance with Applicable Laws; and (e) any other information or documents reasonably requested by Christman. The form and content of all submissions shall be satisfactory to Christman. Sworn statements must include a complete and accurate list of all Lower Tiers including equipment lessors and any entity entitled to assert a lien or bond claim.

12.3 Process On the date of the month specified by Christman, Subcontractor shall submit a payment application in the form and manner specified by Christman, detailing costs accrued and percent of Work complete, through the time period of the month specified by Christman. Subcontractor's determination of percentage of work complete is subject to the approval of Christman, Owner, and/or Architect. Any application not timely submitted may not be included in Christman's payment application to Owner. Subcontractor shall not request payment for any Work for which it does not intend to promptly pay its Lower Tiers. Payment for all materials stored offsite is solely at Christman's discretion.

12.4 Cost Reimbursable Items If Subcontractor is entitled to reimbursement of any costs incurred for the Work (Reimbursable Costs), such as approved Change Order work, payment of Reimbursable Costs shall be made in accordance with cost reimbursement terms of the Prime Contract, or in the absence of such terms, in accordance with this Agreement. Subcontractor shall maintain, in a manner and quality satisfactory to Christman, accounting records for Reimbursable Costs, including, without limitation, Lower Tier invoices, material receiving reports, segregated cost data, payrolls, labor hours, equipment hours, and other documentation necessary to fully substantiate each Reimbursable Cost. These records shall be subject to audit by Christman, the Owner or their designated representatives.

12.5 Joint Payment Subcontractor authorizes Christman to communicate with Subcontractor's Lower Tiers on payment issues and to make payment via joint check to any Lower Tier if, in Christman's sole discretion, Christman determines that joint checks are necessary or appropriate. Subcontractor gives this authorization without the need for any further joint-check arrangement. Christman's payment by joint check shall be deemed to be made directly to Subcontractor. Christman may issue a joint check for the amount shown on Subcontractor's Sworn Statement as due to Lower Tiers, less any setoffs, backcharges, warranty work, or other deductions to which Christman may be entitled. Subcontractor waives any claim against Christman for any errors that may arise out of a joint check payment and accepts responsibility for the validity any endorsements of any joint check. Christman's right to pay by joint check does not create any obligation to do so, and no joint check payee or third party shall have third party beneficiary or other rights to demand joint payment.

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12.6 Removal of Claims Provided Christman has paid Subcontractor in accordance with this Agreement, within 3 days of Christman's written request, Subcontractor shall cause to be discharged any Lower Tier lien or bond claim related to the Work. If Subcontractor fails to do so, Christman, at its sole discretion, may use whatever means necessary to remove such suit, claim or lien and backcharge Subcontractor the cost of so doing. Subcontractor shall be responsible for any costs, including attorney fees, litigation costs, and consultant fees that Christman incurs in removing or attempting to remove such suit, claim or lien, plus a markup of 20% for administrative and overhead expenses (Contractor Markup). If Owner or Christman receive any lien, bond claim or notice of intent to file, Christman may withhold the full amount of such claim, plus Contractor Markup pending adjustment. If Subcontractor defaults in payment of its debts on the Project, Christman shall have the right to pay such debts and charge them to Subcontractor. If Christman determines, in its sole discretion, that the balance of the Contract Sum then remaining unpaid will not be sufficient to complete the Work in accordance with the Contract Documents, no additional payments will be due Subcontractor unless Subcontractor, at no cost to Christman, performs, and pays in full for, a sufficient portion of the Work such that the balance of the Contract Sum then remaining, as determined by Christman, is sufficient to complete the Work.

12.7 Trust Fund Subcontractor shall hold each payment from Christman in trust to satisfy all indebtedness to Lower Tiers first, before paying any other indebtedness of the Subcontractor.

12.8 Withholding Christman may withhold payment to Subcontractor or set off any payment for any of the following reasons: (a) failure to remedy defective Work or perform clean-up; (b) off-site fabrication not meeting production quotas or quality standards; (c) Subcontractor has damaged any portion of its Work or the work of others; (d) claims, levies, liens, attachments, stop notices or court orders or reasonable evidence indicating probable filing of such claims, including unpaid insurance claims arising out of the

Work; (e) allegations that Subcontractor has not timely paid employees or Lower Tiers or Subcontractor fails to produce proof requested by Christman of such payments; (f) there exists reasonable doubt in Christman's sole discretion that the Work can be completed for the unpaid balance of the Contract Sum or within the Project Schedule; (g) unsatisfactory prosecution of the Work; (h) failure to deliver current insurance certificates, bonds, submittals, shop drawings, SOVs, "as built" drawings, written guarantees or warranties, or the approvals required of the Work by any authority having jurisdiction; (i) Christman is exposed to an Owner claim for liquidated damages arising in whole or in part from the Work; (j) a petition for bankruptcy or reorganization is filed by or against Subcontractor or Subcontractor has made an assignment without Christman's prior written consent; (k) Subcontractor is unlicensed or its license is invalid or lapsed; (l) any violation of Applicable Laws; (m) Subcontractor expresses an intent to repudiate the Agreement or reduce its work force, equipment, or materials; and (n) any circumstance that would constitute a Subcontractor Default, even if Christman has not declared a Subcontractor Default.

12.9 Contract Balance Subject to the absolute conditions precedent in this Article and Applicable Laws, the balance of the Contract Sum (Contract Balance) is defined as that amount payable to Subcontractor after Christman exercises any right to withhold or offset the Contract Sum. The Contract Balance does not include pending or disputed change order work. No Subcontractor surety bond shall alter this definition or prevent Christman's exercise of the right to withhold or setoff before making any Contract Balance available to surety under any bond.

12.10 Final Payment As an absolute condition precedent to Christman's obligation to make final payment of the Contract Balance to Subcontractor, Subcontractor shall submit to Christman: (a) an affidavit to Christman's satisfaction that Subcontractor has paid all indebtedness connected with the Work; (b) consent of surety, if required by Christman; (c) satisfaction of required closeout procedures and documentation; (d) receipts, releases, and waivers of lien and/or bonds in the form designated by Christman or Owner and other satisfactory evidence that there are no liens, bond claims, or other indebtedness related to the Work; and (e) Subcontractor's written Warranty. Upon Subcontractor's satisfaction of this condition precedent, after Subcontractor's application for final payment, and after Owner's acceptance of and payment for all Work, Christman shall pay the Contract Balance to Subcontractor. If Owner asserts a claim for, or assesses and retains against Christman any liquidated damages, Christman's payments to Subcontractor shall be reduced to the extent such assessment is attributable to Subcontractor. Subcontractor shall not assert a claim for retention until Owner's assessment of liquidated damages is finally resolved. Subcontractor's acceptance of final payment shall be deemed a final waiver of all claims of any nature against the Owner and Christman, but shall not relieve Subcontractor of liability for indemnity and warranty obligations, or for faulty or defective work appearing before or after final payment. To the extent permissible by Applicable Laws, all payments, including final payment, shall be out of such equivalent payments Christman receives from the Owner. Christman's receipt of such payments is an absolute condition precedent to payment to Subcontractor.

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ARTICLE 13 - CHANGES AND EXTRA WORK

13.1 Changes Without invalidating this Agreement, Christman may make any changes by altering, adding to, or reducing the extent and/or scope of the Work, including the deletion of any major items of work to be completed. Except as provided below, no change in the extent or scope of such Work shall be made except by a Change Order signed by Christman. The charge or credit for any such changes shall be determined, at Christman's option, by any of the following methods: (a) agreed upon lump sum price; (b) unit prices named in this Agreement or subsequently agreed upon in writing; or (c) time and material. Subcontractor shall submit for approval a quotation covering any change in the Work which affects the Contract Sum. The quotation shall contain a detailed itemization of costs and shall identify any impact on the Project Schedule, Subcontractor's progress of the Work, milestone dates, and/or the Substantial Completion date. Subcontractor shall submit its quotation within 7 days' of receipt of notification of the change, or such shorter time as Christman directs. If the Parties cannot agree about whether there exists a change in the Work or cannot agree on the amount of the addition or deletion, to maintain the Project Schedule, pending final resolution of the Change Order, Subcontractor shall nonetheless timely perform the Work as changed by Christman's written direction and proceed in accordance with Article 13.4.

13.2 Written Authorization Subcontractor shall not perform any changes or additional work except upon Christman's prior written direction. If Subcontractor proceeds without such written authority, Subcontractor expressly waives any and all claims for additional payment. No oral or other claimed waiver of the requirement of prior written authority shall be binding. An increase in the Contract Sum by virtue of such change shall not occur until a Change Order has been issued and signed by Christman and

Subcontractor, and, for Owner or Architect initiated changes, Owner has signed a Change Order. Any adjustment in the Contract Sum, Project Schedule or other provisions as set forth in each Change Order shall operate as an Accord and Satisfaction and shall constitute the full, final and complete compensation to Subcontractor for the entire cost and schedule effect related to the stated changes and the cumulative impact and effect resulting from the stated changes on all prior Work and prior changes in the Work. Subcontractor waives any claims for any other additional compensation, damages or time extensions in connection with the stated changes. The Contract Sum may be equitably adjusted by Christman by written Change Order or directive issued by Christman, with or without Subcontractor's consent, for reasonable backcharges and adjustments to the Contract Sum permitted under this Agreement.

13.3 Signature With the exception of backcharges, all Change Orders must be approved and signed either by Christman's representative who executed this Agreement or another representative on the same or higher level of authority. No changes to the Agreement may be made or agreed to by any field personnel. Email, texts, or other electronic means of communications shall not be sufficient to establish a Change Order. Field representatives may not authorize or sign for changes in the Work or additional work and do not have any authority to agree to or approve changes. Superintendents may sign time tickets for the sole purpose of documenting time on the Project; under no circumstances shall such signature be deemed to accept or authorize additional work or otherwise obligate Christman to pay for such work, notwithstanding any language on Subcontractor's time ticket or other documentation to the contrary.

13.4 Claims If Subcontractor intends to assert any claim for additional compensation or schedule extension, as an absolute condition precedent to such claim, Subcontractor's notice and claim shall strictly conform to Articles 14 and 15.

ARTICLE 14 - TIME

14.1 Schedule Time is of the essence. Within the time specified by Christman, Subcontractor shall provide Christman with scheduling information and a proposed schedule for performing the Work which shall include a projection of labor hours and crew sizes, all in forms acceptable to Christman. Subcontractor's proposed schedule shall conform to the Project Schedule and all revisions or changes made to the Project Schedule from time-to-time. Subcontractor shall maintain the specified rate of progress for its Work and shall complete the Work on or before the dates set by Christman for Subcontractor's Work. Subcontractor shall perform the Work in a prompt and diligent manner without delaying or hindering the work of others. The Project Schedule is not a representation by Christman that Subcontractor will be able to perform its activities on certain dates. Subcontractor acknowledges that as construction progresses it may be necessary for Christman to change the sequential order and duration of activities to account for unanticipated delays, occurrences, and other factors that alter Christman's schedule. Christman may require Subcontractor, at no additional cost to Christman, to prosecute the Work in such sequence as the progress of other trades and the Project Schedule reasonably dictate. Scheduling may require temporary omission of the Work at locations determined by Christman. All patches, fill-in and "come back" work for the proper completion of the Work shall be included in the Contract Sum. Subcontractor expressly agrees that the reasonable scheduling and sequencing of the Work is Christman's exclusive right and that Christman reserves the right to reasonably reschedule and re-sequence the Work from time to time as the demands of the Project require without additional cost or expense to be paid to Subcontractor. Christman's exercise of any rights or remedies under this Agreement, including ordering changes in the Work, directing suspension, rescheduling or correction of the Work, regardless of the extent or frequency of Christman's exercise of such rights or remedies shall not be construed as active or unreasonable interference with Subcontractor's performance of the Work.

14.2 Failure to Progress If Subcontractor delays or disrupts the progress of any work, Subcontractor shall, at its own cost and expense, take such action as Christman deems necessary or appropriate to improve Subcontractor's rate of progress, including, but not limited to, increasing the number of superintendents, foemen, skilled and unskilled labor, increasing the number of crews and or shifts, employing more or better equipment, working overtime, expediting delivery of materials, changing sequence of performance, prosecuting parts of the Work in preference to other parts, and any other increase or acceleration effort to avoid or mitigate delays. Subcontractor shall be subject to liquidated or other damages on the basis stated in the Prime Contract if Subcontractor causes or contributes, in whole or in part, to any delay, even if concurrent, which would allow the Owner to assess liquidated or other damages against Christman. Regardless of whether liquidated damages are specified, Subcontractor shall be liable to Christman for any loss, damage or liability of Christman, caused in whole or in part by delays, disruptions or other reasons attributable to Subcontractor.

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14.3 Cure If Subcontractor fails to correct, replace and/or re-execute faulty or defective Work or materials, fails to maintain the progress of its Work in a timely and proper manner and with such effort, speed and diligence to maintain the Project Schedule, current revisions of milestone dates, interim completion dates, activity durations, or otherwise fails to facilitate the orderly progress of the Project, or is unable to proceed with the Work because of any labor dispute, then Christman, upon 48 hours' notice to Subcontractor, shall have the right to correct, replace and/or re-execute such faulty, defective, damaged or delayed work, or to supplement Subcontractor's crews, or to take over this Agreement with all materials of the Subcontractor on the site and complete the remaining Work, charging such cost to Subcontractor. Under such circumstances, Christman shall also have the right to withhold payments to Subcontractor until Subcontractor pays Christman in full for such costs.

14.4 Time Extension If, without fault or cause by Subcontractor, Subcontractor's performance is delayed, and provided that such delay is not concurrent with a delay caused by Subcontractor, Subcontractor may request an extension of time for performance, but shall not be entitled to any increase in the Contract Sum, any additional compensation, damages for schedule compression, acceleration, stacking, or loss of labor/equipment productivity, or consequential damages, as a result of such delays, such extension of time for performance being Subcontractor's sole and exclusive remedy for any schedule or delay related claim. Notwithstanding the foregoing, Christman will cooperate with Subcontractor in submitting to Owner any just claim arising from delay which is permitted by the Contract Documents and by applicable law.

14.5 Claims Any claim for a time extension shall strictly comply with the Claim provisions in Article 15.

ARTICLE 15 - CLAIMS

15.1 Owner Claims For any claim by Subcontractor seeking payment of money or a schedule extension because of any act, failure to act, default or interference by the Owner and/or the Architect, and/or their respective subcontractor or suppliers, the Subcontractor shall carefully observe all terms and conditions of the Prime Contract relating to claims and shall give Christman timely written notice of such claim in the form required by the Prime Contract. Subcontractor shall specifically label the notice a "Notice of Claim." Unless expressly prohibited by Applicable Laws, Subcontractor shall provide such notice, no later than 5 days before the time Christman is required to make such claim to the Owner under the Prime Contract, or within 5 days of the beginning of the event giving rise to the claim, whichever is earlier. Subcontractor shall not claim any time extension, cost reimbursement, compensation, or damages for any delay, disruption, or interference except to the extent that Christman is entitled to a corresponding time extension, cost reimbursement, compensation, or damages from Owner under the Contract Documents and Applicable Laws. Subcontractor shall be solely responsible for all attorneys' fees, costs, and expenses (Pursuit Costs) Christman incurs in submitting such claim and shall reimburse Christman on a monthly basis for Pursuit Costs. Subcontractor's recovery shall be limited to the amount, if any, that Christman actually receives from Owner for Subcontractor's claim. To the extent permitted by Applicable Laws, Owner's payment to Christman for such claim shall be an express condition precedent to Christman's duty of payment to Subcontractor.

15.2 Contractor Claims For any claim by Subcontractor against Christman seeking payment of money or a schedule extension or other relief with respect to the terms of this Agreement because of any claimed act, failure to act, default or interference by Christman or Christman's other subcontractors, Subcontractor shall give Christman written notice no later than 5 days from the beginning of the event giving rise to the claim. Such notice shall be specifically labeled a "Notice of Claim" and served in accordance with 15.5.

15.3 Claim Substantiation For all claims, within 14 days of providing a timely Notice of Claim, Subcontractor shall provide Christman with: (a) detailed actual cost records supporting the claim and identifying the actual discrete costs attributable to the claim; (b) an affidavit under oath by an officer of Subcontractor certifying and stating (a) the specific relief sought; if money is sought, the specific dollar amount sought; (b) that the actual discrete costs claimed are true and correct. The affidavit must contain or attach sufficient supporting documentation to reasonably allow its consideration, including without limitation, any documentation required by the Contract Documents.

15.4 Claim Calculation Subcontractor agrees that the total cost approach of calculating damages, or variations thereof (collectively, TCA) or any other method of calculating claims through estimating based upon the measured mile analysis (MMA),

Sample

earned value analysis (EVA), or the use of industry standards, is inherently unreliable and uncertain. Therefore, Subcontractor waives any damages based on the TCA, MMA, or EVA, and/or any claim based on estimated costs or industry guidelines such as the Mechanical Contractors Association of America, the National Electrical Contractors Association, or any other organization. As an absolute condition precedent to any claim, claims must be based upon a discrete actual costs analysis supported by contemporaneously (daily) documented actual costs properly allocated to the claim. Subcontractor waives any claim not contemporaneously documented and properly allocated. If Christman receives Subcontractor daily time reports, such receipt shall be deemed solely for documentation purposes and not as an admission of quantity, validity or liability of a claim.

15.5 Delivery of Notice For all claims, Subcontractor shall provide written notice via certified or registered mail to the address on page 1 of this Agreement. **EMAIL OR FACSIMILE OF A NOTICE OF CLAIM IS PROHIBITTED AND IS INSUFFICIENT TO ESTABLISH NOTICE.**

15.6 Strict Compliance Subcontractor's strict compliance with all claim requirements (timely notice, form, substantiation, calculation and delivery) is a strict and absolute condition precedent to any claim and the failure to adhere to any one of these requirements is an absolute defense to the claim. Subcontractor waives any claim that does not strictly comply with Article 15 and Christman shall not be liable to Subcontractor on any claim not timely or properly presented. Christman's actual or constructive notice of a claim shall not satisfy or excuse Subcontractor from strict compliance nor prevent Subcontractor's waiver of the claim. If Subcontractor does not strictly comply with this Article or if Christman cannot in good faith certify or submit Subcontractor's Owner Related Dispute to Owner, Christman is not obligated to do so.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Owner Related Disputes In case of any dispute between Christman and Subcontractor, which in Christman's sole opinion is in any way related to or arising from any act or omission of the Owner or Architect/Engineer, (Owner Related Dispute), Subcontractor shall be bound to Christman to the same extent that Christman is bound to Owner by the Contract Documents and by any and all preliminary and final decisions, determinations or agreements made by Christman and Owner or so authorized in the Contract Documents or by the court or arbitrator designated in the Contract Documents whether or not Subcontractor is a party to such agreement or proceeding. Subcontractor shall stay any and all legal actions against Christman or its surety until a final non-appealable decision has been obtained from or against the Owner as to the Owner Related Dispute. Christman and its surety shall not be liable to Subcontractor in excess of any sum actually received from Owner for Subcontractor's Owner Related Dispute. Unless expressly prohibited by Applicable Laws, Christman's receipt of payment from the Owner for Subcontractor's Owner Related Dispute is a strict condition precedent to Christman's and its surety's obligation to pay Subcontractor.

Sample

16.2 All Other Disputes All disputes arising out of or relating to this Agreement or any performance or payment bonds furnished by either party shall first be resolved in the following order: (1) by a meeting of the project management on site, within 7 days of the date a party requests such meeting; (2) if that fails, by a meeting of the principals in charge for each Party within 10 days following the project management site meeting; (3) if that fails, within 30 days after the principals in charge meeting, by mediation where the Parties select a mediator, the costs of which shall be shared equally. All disputes and claims that are not disposed of as provided herein shall be resolved by submission to the state or federal court whose district includes the county where the Project is located (Controlling Venue). The Controlling Venue is the exclusive venue for any claim and litigation may only be filed in that county. Subcontractor consents to personal jurisdiction in any court whose jurisdiction includes the Controlling County. **The Parties waive their right to a trial by jury and acknowledges that they have had the opportunity to seek the advice of legal counsel before waiving this right**.

16.3 No Stop Work Pending the resolution of any dispute, Subcontractor, without waiver of its other rights and remedies, shall not stop work or reduce its labor force, equipment, or progress, and shall diligently proceed with the Work.

ARTICLE 17 - DEFAULT AND TERMINATION

17.1 Adequate Assurance If at any time Christman deems in its sole discretion, that there are reasonable grounds of insecurity as to Subcontractor's ability to properly and timely perform, Christman may give Subcontractor written demand for adequate assurance of performance. Subcontractor shall provide such assurance, reasonably acceptable to Christman, within 10 days after Subcontractor's receipt of written demand.

17.2 Subcontractor Default Any of the following shall be considered a Subcontractor Default: (a) default in the performance of any requirement of this Agreement or the Prime Contract insofar as the Work; (b) failure to provide a sufficient crew of skilled workers and proper quantity and quality of equipment and materials as and when required; (c) failure to maintain the progress of its Work in a timely and proper manner and with such effort, speed and diligence to maintain the Project Schedule, current revisions of milestone dates, interim completion dates, activity durations, or otherwise failing to facilitate the orderly progress of the Project as a whole; (d) reduction in work force, equipment or materials, or abandonment of portions of the Work; (e) interference with the performance of others on the Project; (f) failure to timely pay any Employer Contributions, labor employed by Subcontractor, or any Lower Tiers; (g) failure to pay or to maintain satisfactory credit relationships for the purchase of labor, supplies, materials, equipment, and services; (h) repudiation or anticipatory repudiation of all or part of the Agreement; (i) failure to provide adequate assurance of timely performance; (j) failure to timely remedy any defects in Work; or (k) failure to perform in strict accordance with Christman's safety requirements.

17.3 Notice to Cure / Remedies If Subcontractor commits a Default and fails to commence and continue satisfactory correction of the Default within 48 hours after receipt of a written Notice of Default, then Christman, at its option, and in its sole discretion, and without prejudice to any other right or remedy, shall have the immediate right to any or all of the following remedies: (a) supplement Subcontractor's Work; (b) enter on the site of the Work and take possession of, for the purpose of completing the Work, Subcontractor's material; (c) employ any other person or persons to finish the Work; (d) provide materials or equipment to complete the Work; (e) terminate Subcontractor and/or Subcontractor's right to proceed; or (f) take whatever other or additional steps Christman deems, in its sole discretion, are in the best interests of Christman or the Project. Notwithstanding the terms of any surety bond to the contrary, Christman shall have the absolute right to exercise any remedy at the cost of Subcontractor or its sureties and shall have the right to enforce any bond right if Subcontractor is declared in Default, during Subcontractor's attempted cure of Default, and/or during surety's investigation of Default. Christman's exercise of any remedy shall not be deemed to impair, prejudice, extinguish, or otherwise diminish any obligation of Subcontractor's surety, nor shall it impair, prejudice, extinguish or diminish the rights of Christman under any such bond.

Sample

17.4 Assignment If Christman elects in writing, in its sole discretion, and effective only upon Christman's termination of Subcontractor's right to proceed, Subcontractor shall assign to Christman any Lower Tier contract for the Work. Subcontractor shall include provisions in its Lower Tier contracts for such assignment without further consent of such Lower Tiers.

17.5 Set Off Christman shall be entitled to recover from Subcontractor and its sureties (as applicable), all expenses, damages, and liabilities Christman incurs as a result of a Default including the cost of labor and materials to complete the Work, acceleration costs incurred in performing the work or engaging others to perform the Work, costs paid to other subcontractors, additional supervision, consultant fees, attorney's fees, and liquidated damages, plus Contractor Markup (collectively, Default Damages). Christman shall have the immediate right to offset or deduct the Default Damages from any money due or to become due to Subcontractor and thereby reduce any unpaid balance of the Contract Sum, notwithstanding any term in a surety bond to the contrary. Subcontractor and its sureties shall remain liable to Christman for Default Damages as they continue to accrue, without waiver of or prejudice to any other right, remedy or claim Christman may have. If a Default occurs, Subcontractor shall not be entitled to any further payment until Owner finally accepts the Work, and until after Christman offsets or deducts Default Damages. If the Default Damages exceed the unpaid balance of the Contract Sum, then Subcontractor and/or its surety shall pay the difference to Christman. If it is determined, by litigation, arbitration or otherwise, that any remedy exercised by Christman, including a termination for Default, was unjustified, such remedy or termination shall be deemed for convenience and Subcontractor's remedies shall be limited to those provided for as a termination for convenience.

17.6 Termination for Convenience Christman may terminate this Agreement for convenience by written notice to Subcontractor for any reason provided in the Prime Contract or within Christman's sole discretion. If a Termination for Convenience occurs, Christman shall only be obligated to pay Subcontractor, as otherwise provided for and in accordance with the terms of this Agreement, and as Subcontractor's sole and exclusive remedy: (a) that portion of the cost of the Work allocable to the portion of the Project satisfactorily performed by Subcontractor before the effective date of termination, plus reasonable overhead and profit on such work; and (b) demobilization costs as properly substantiated by proof acceptable to Christman. Under no circumstances shall Subcontractor be entitled to recover for profit and overhead on work not performed before the notice of termination for

convenience.

ARTICLE 18 - MISCELLANEOUS

18.1 Calendar Day All references in this Agreement to days shall mean calendar days.

18.2 Assignment Subcontractor shall not assign or subcontract this Agreement or any portion thereof, nor assign any payment, claims or rights under this Agreement to any third party without Christman's prior written consent. Consent will not be given to any proposed agreement that would relieve the Subcontractor or its surety of their responsibilities under this Agreement. Christman may assign this Agreement to its surety, joint venture partner, an affiliate, or other third party. Christman may also assign this Agreement to Owner, its designated assignee, or lender, in accordance with the terms of the Prime Contract or Owner's loan documents associated with the Project.

18.3 Ownership of Work Product Subcontractor grants to Christman and the Owner if required by the Prime Contract, all ownership and property interests in all Subcontractor Work Product. To the extent Subcontractor Work Product includes or otherwise utilizes trade secrets, copyrighted materials or other similarly protected intellectual property, Subcontractor grants to Christman a license for the use of such Work Product solely and exclusively for the Project.

18.4 Data Ownership & Confidentiality Engineering, architectural, or other information provided pursuant to this Agreement is the property of Christman (or the Owner if so provided in the Prime Contract) and is not to be reproduced or disclosed to others or used for other purposes without Christman's written permission. All information about the Project. Christman's systems, processes, procedures, and other operations, and the Owner's systems, processes, procedures, and business operations shall be kept strictly confidential by Subcontractor and its Lower Tiers unless otherwise prohibited by Applicable Laws or to the extent exceptions are permitted by written approval from Christman. If confidential information is disclosed by Subcontractor or its Lower Tiers, Subcontractor shall immediately notify Christman of the unauthorized disclosure and details pertaining to what was disclosed, to whom and when the disclosure occurred. Subcontractor shall be responsible to Christman and to the extent applicable in the Prime Contract, to the Owner for any unauthorized disclosure.

Sample

18.5 E-Data Except as to a Notice of Claim, the parties may exchange and execute records in electronic form. Christman disclaims any representation or warranty as to the functionality of the software or computer program associated with electronic transmission of records. Christman disclaims any warranty, express or implied, including the warranty of fitness for a particular purpose, as to the information transmitted in electronic form.

18.6 Integration This Agreement including incorporated documents is the entire agreement between the Parties, supersedes and cancels any prior written or verbal agreements, and constitutes the only agreement between the Parties for the Work and the Project. Except for Christman backcharges to Subcontractor, no terms of this Agreement or the nature and extent of the Work shall be waived, modified, reduced, or enlarged, except in writing signed by both Parties. No additional or contrary term in any Subcontractor document related to this Agreement is binding on Christman.

18.7 Controlling Law This Agreement is governed by the law of the Controlling State and to the extent applicable, all federal laws, rules and regulations. The term "State" includes all 50 states, the District of Columbia, Puerto Rico, and any other unincorporated territory of the U.S.

18.8 Independent Contractor Subcontractor shall be deemed to be an independent contractor fully responsible for the means, methods and safety measures and procedures utilized fulfilling the scope of services or terms of this Agreement. Under no circumstances shall the Subcontractor be deemed to be an employee or joint venturer with Christman.

18.9 Authority Subcontractor affirms that its signatory to this Agreement is an authorized agent of Subcontractor, with full authority to enter into this Agreement on behalf of Subcontractor. This Agreement may be executed electronically and a copy of a signed Agreement may be exchanged via email in which case signatures shall be deemed binding for all purposes and an original signature is not required.

18.10 Severability If any portion of this Agreement is deemed invalid or unenforceable, such term may be severed from this Agreement and the remainder of the Agreement shall be valid and enforceable to the fullest extent permitted by law.

18.11 Work Before Signing Subcontractor's liabilities and obligations to Christman hereunder shall apply to all the Work, even Work that may have been performed before the date of this Agreement pursuant to prior negotiations, representations, agreements, understandings or otherwise. Notwithstanding a later signing of this Agreement by Christman or Subcontractor, this Agreement is deemed effective on the date Subcontractor first commences any Work.

18.12 Enforcement Christman's failure to insist in any one or more instances on Subcontractor's performance of any term or condition of this Agreement, or failure to exercise any of its rights, shall not constitute waiver or relinquishment of such term, condition, or right as to further performance or Christman's right to enforce any term or condition. Christman's waiver of any term, condition, or rights shall be made in writing and such written waiver shall not be deemed a waiver of any other term or condition.

ARTICLE 19 - EXHIBITS

The following Exhibits, whether attached hereto or not, are incorporated by reference.

Exhibit I	Supplement A
Exhibit II	Christman's Safety Program
Exhibit III	Payment & Performance Bonds
Exhibit IV	Supplement B, if applicable

Sample

[SIGNATURE PAGE TO FOLLOW]

ACCEPTANCE

The said parties, for themselves, their heirs, successors, executors, and administrators and assignees, do hereby agree to the full performance and covenants contained herein.

By signing below these parties affirm that they are each authorized agents of their respective organizations, with full rights and privileges to enter into this Agreement on behalf of those respective organizations. This Agreement may be executed by facsimile signature, or a copy of a signed Agreement may be delivered via email by either party and such signature will be deemed binding for all purposes hereof without delivery of an original signature being thereafter required.

Signature	Signature
Print Name	Print Name
Title	Title
Date	Date

Sample

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

2022 Bond Issue Construction as identified in the preliminary qualification of bonds application # SBL/33-020-4-K12-28-01, in accordance with the Owner-approved plans and specifications, all applicable laws, the Owner's fixed budget, and as otherwise approved by the Owner.

THE OWNER:
(Name, legal status and address)

Lansing School District
519 West Kalamazoo Street
Lansing, Michigan 48933
Telephone Number: (517) 755-1000

THE ARCHITECT:
(Name, legal status and address)

C2AE
106 West Allegan Street, Suite 500
Lansing, MI 48933

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the ~~Agreement,~~ Agreement in writing, the Contract Documents ~~do not~~ also include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, accepted portions of the Contractor's bid or proposal, ~~or~~ and portions of Addenda relating to bidding or proposal requirements. The Contractor's execution of the Owner/Contractor Agreement and the Architect's execution of the Owner/Architect Agreement shall constitute their respective acceptance of all provisions of the Drawings, Addenda, and all Contract Documents as of the revision applicable to the date of such signature.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate the Contractor's performance of ~~the Architect's~~ its duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions or interpretations, as applicable, on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.1.9 The term "Product(s)" as used in the Contract Documents refers to the materials, systems and equipment provided by the Contractor for use in the work of the Project.

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§ 1.1.10 The terms "Warranty" and "Guarantee" as uscd in the Contract Documents shall have the same meaning and shall be defined as "legally enforceable assurance of satisfactory performance or quality of a product or Work," but in all events subject to the terms and qualifications of the Contract Documents.

§ 1.1.11 Where materials, systems and equipment items are referred to in the singular, such reference shall not serve to limit the quantity required. The Contractor shall furnish quantities as required by the Contract Documents to complete the Work.

§ 1.1.12 Unless specifically limited in the Contract, the words "furnish," "install," and "provide," or any combination thereof, mean to furnish and incorporate into the Work, including all necessary labor, materials, and equipment and other items required to perform the Work indicated.

§ 1.1.13 The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. If the Drawings and Specifications conflict with each other regarding the quality or quantity of Work required, the better quality and/or the greater quantity shall govern, and shall be provided, unless instructions are otherwise furnished to the Contractor by the Architect in writing with the Owner's consent.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where responsibility for particular Work is required of the Contractor, the Contractor shall not be released from that responsibility by reason of the location of the Specification, Drawing, or other information that establishes the responsibility. Thus, for example, the Contractor shall be responsible for all Work required of it, even though that responsibility may be shown only in that portion of the Contract Documents typically pertaining to another contractor or trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 If there should be a conflict between two or more of the Contract Documents, the following order of interpretation shall apply.

.1 Where requirements specifically set forth in the Agreement are in conflict with other Contract Documents, including, but not limited to, these General Conditions, the Agreement shall govern.

.2 In all other instances, the conflict shall be resolved by complying with the provision that is most favorable to the Owner, as determined in the Owner's sole discretion.

.3 When a duplicate of material or equipment occurs in the Drawings, the Specifications or other Contract Documents, each Contractor shall be deemed to have bid on the basis of each furnishing such material or equipment. The Owner will decide which Contractor shall furnish the same.

§ 1.2.4.1 Without limiting the applicability of Section 1.2.4, if there should be conflict or ambiguity within any single Contract Document (for example, these General Conditions, as modified), the conflict or ambiguity shall be resolved by complying with the provision that is most favorable to the Owner, as determined in the Owner's sole discretion.

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§ 1.2.5 It is the intent of the Contract Documents to accomplish a complete and workmanlike installation in which there shall be installed new products as specified, and workmanship shall be thoroughly first class, executed by competent and experienced workmen.

.1 Details of preparation, construction, installation, and finishing encompassed by the Contract Documents shall conform to the industry standards of the respective trades, and that workmanship and construction methods shall be of workmanlike quality so as to accomplish a neat and finished job, consistent with industry standards.

.2 Where specific recognized standards are mentioned in the Specifications, it shall be interpreted that such requirements shall be complied with.

§ 1.2.6 The Contractor acknowledges that there may be items of the Work that the Contractor is responsible to provide under the Contract Documents that are not drawn or specified in the design but are necessary for the proper execution and completion of the Work, and are consistent with, and reasonably inferable from, the Drawings and Specifications. Provided the necessary work or materials does not materially increase the cost of the Work, all such items shall be provided as part of the Work without delay in its progress and without any increase in the Contract Sum.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and unless otherwise indicated in the Contract Documents or the Owner/Architect Agreement, the Architect and the respective consultants will retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of ~~Service provided to them,~~ Service, subject to any protocols established pursuant to ~~Sections 1.7 and 1.8,~~ Section 1.7, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.5.3 The Drawings, Specifications, and other documents and all data used in compiling any tests, surveys, or inspections at the Project Site and the results therefrom, as well as all photographs, drawings, specifications, schedules, data processing output, computer-aided design/drafting (CADD) system disks/tapes, computations, studies, audits, reports, models and other items of like kind, and all intellectual property, prepared or created for or in connection with the Project and required by the Owner, the Contractor, or a third party, belong to the Owner. The Contractor may retain one record set. All copies of them, except Contractor's record set, shall be returned or suitably accounted for upon completion of the Work. They are for use solely with respect to the Project. The Contractor shall not, without the prior written consent of the Owner, use or permit anyone to use any Drawings, Specifications, or other documents prepared for or in connection with the Project, or any concepts or ideas developed in connection with the Project, for any purpose other than the Project. The Owner shall at all times have access to and control over the disposition of any Drawings, Specifications, and other documents pertaining to the Project.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to ~~the designated~~ an appropriate representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by

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registered or certified mail, by courier, or by electronic transmission if ~~a method for electronic transmission is set forth in the Agreement.~~an acknowledgment of receipt is received from the recipient or proof of receipt is otherwise established. The parties acknowledge that an appropriate representative of the Owner shall have authority only to the extent provided by the Owner's Board of Education.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to ~~the designated~~ an appropriate representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery. The parties acknowledge that an appropriate representative of the Owner shall have authority only to the extent provided by the Owner's Board of Education.

§ 1.7 Digital Data Use and Transmission

The parties ~~shall~~ may agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form.~~The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.~~

~~**§ 1.8 Building Information Models Use and Reliance**~~

~~Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.~~

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to ~~all~~ matters requiring the Owner's approval or ~~authorization.~~ authorization subject to parameters of authority established by the Owner's Board of Education as provided in writing to Contractor. Benjamin Shuldiner or his designee shall serve as initial Owner representatives and shall be reasonably available to Contractor. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 ~~The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.~~**NOT USED.**

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall ~~furnish~~ furnish, as applicable, to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended ~~appropriately.~~appropriately by a mutual agreement in writing by the Owner and Contractor.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall immediately notify the Owner that the Work has ~~stopped.~~ stopped and state with specificity why any evidence provided (or not provided) by the Owner is insufficient. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this

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Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents. The parties' disagreement as to the appropriateness of payment for services performed shall not constitute the Owner's failure to make financial arrangements to fulfill the Owner's obligations under the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where information is protected by law and/or the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose such "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. ~~The~~ To the extent permitted by law, the Contractor may also disclose such "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, ~~including~~ including, but not limited to, those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the ~~jurisdiction where the Project is located.~~ State of Michigan. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor ~~to whom the Contractor has no reasonable objection and~~ whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. ~~The~~ Taking into account the Contractor's experience and expertise, and exercise of professional caution, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work. The Contractor shall not be entitled to additional compensation resulting from its failure to confirm the location of site utilities or existing structures.

§ 2.3.5 ~~The~~ Upon specific written request by the Contractor, the Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services. Contracts with other Contractors alone shall not constitute sufficient Owner control for purposes of this Section.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or ~~repeatedly~~ fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. This right shall be in addition to and not in limitation of the Owner's rights under any provision of the Contract Documents.

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§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ~~ten-day~~ three business day period after receipt of notice from the Owner or the Owner's designee (including, for this purpose, the Architect) to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, ~~correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may,~~ including any claim against the Contractor's Performance Bond, correct such default or neglect. In the event the Contractor's default or neglect results in a threat to the safety of persons or property, the Contractor shall immediately commence and continue correction; otherwise, the Owner may undertake the same actions as permitted in the prior sentence. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses, including any and all legal expenses incurred to effectuate and enforce this provision, and compensation for the Architect's and/or other Contractor's additional services made necessary by such default, neglect, or failure. If the Contractor does not agree to a Change Order as described in the preceding sentence, the Owner may nevertheless withhold the reasonable cost of correcting such deficiencies and the expenses identified in the preceding sentence (including, but not limited to, all legal expenses incurred to effectuate and enforce this provision). Exercise of such rights shall in no way limit or jeopardize the Owner's right to any claim against the Performance Bond or Contractor. The Architect may also, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including the aforementioned Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15. In the event the Owner directs another entity to perform Work pursuant to this Section that otherwise is the obligation of the Contractor, including correction of safety violations, either at the Contractor's request or as a result of the Contractor's failure to perform such Work, the Owner may withhold any payments due Contractor to cover all costs for labor, material, and equipment plus that other entity's administrative, profit, and overhead costs. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 These General Conditions refer to the relationship between the Owner and Contractor. As to the contract between the Contractor and its Subcontractors, the General Conditions shall be read as the Contractor having the position of the Owner and the Subcontractors having the position of the Contractor. The Subcontractors are bound to the Contractor just as the Contractor is bound to the Owner. The Subcontractor shall have all the rights, duties and obligations to the Contractor as the Contractor has rights, duties and obligations to the Owner. The Subcontractors shall agree to and accept the same responsibility to the Owner as the Contractor. In the event any failure of a Subcontractor or the Subcontractor's Subcontractor or supplier, at any tier, causes any type of defective Work, injury, loss or damage to the Owner, direct or indirect, the Contractor shall be jointly and severally liable to the Owner for such injury in addition to any responsibility or liability of the Subcontractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal

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observations with requirements of the Contract Documents. The Contractor shall independently verify all information related to utilities prior to beginning the Work. The Contractor shall make careful investigation to establish the exact location of any such items indicated on the Drawings (e.g., locate via hand digging before excavating). The Contractor shall be responsible for all costs arising out of damage to such items or additional construction costs incurred because Contractor failed to verify said information.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may ~~require.~~require, with a copy of same to be forwarded to the Owner.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the ~~Owner, subject to Section 15.1.7,~~ Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.5 Prior to submitting its bid, the Contractor shall have studied and compared the Contract Documents and shall have reported to the Architect any discovered error, inconsistency or omission in the Contract Documents. It will be presumed that the Contract Sum includes the cost of correcting any such error, inconsistency or omission, which could have been discovered by the exercise of reasonable diligence. Unless the Contractor establishes that such error, inconsistency or omission could not have been discovered by the exercise of reasonable diligence, the Contractor and the bidding Subcontractor(s) will make such corrections without additional compensation so that the Work is fully functional.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures. The Contractor shall immediately notify the Architect and Owner of delays of any other Contractors that could impact timely coordination and completion of the Work.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

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§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. The Contractor shall be deemed to have accepted prior work when it commences provision of subsequent Work and shall be responsible for the cost of repair, replacement, or reconstruction if the prior work is found to be improper.

§ 3.4 Labor and Materials and Utilities

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Such provision of labor and materials shall occur in sufficient time to satisfy the existing Project schedule. The Contractor bears the risk of any failure to timely provide such labor and materials for any reason. The Contractor agrees to execute the appropriate UCC forms to effectuate the Owner's ownership of the material and equipment furnished pursuant to this Agreement.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 The Contractor agrees that neither it nor its Subcontractors will discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to hire, tenure conditions or privilege of employment, or any matter directly or indirectly related to employment, because of race, age, sex, color, religion, national origin, ancestry or physical disability. Breach of this covenant may be regarded as a material breach of this Contract.

§ 3.4.5 Immediately after "award of the Contract," the Contractor shall provide the Architect a list showing the name of the manufacturer proposed to be used for each of the product(s) identified in the Specifications and, where applicable, the name of the installing Subcontractor.

§ 3.4.6 The Architect will reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data.

§ 3.4.7 In all cases involving utilities, unless the Contract Documents specifically provide otherwise, it shall be the Contractor's responsibility to coordinate the Work with the owners of such utilities for the protection of such utilities and for the safety associated with working with or in the vicinity of such utilities. The Contractor shall coordinate any work required by private and/or public utility companies to provide utilities to the Work and/or shall coordinate relocation of utilities as required by the Work. Any reference to the Owner being responsible for the coordination of, the paying for, or the relocation of any utility or associated equipment, which it does not own or control, requires only reasonable efforts by the Owner to coordinate such activity.

§ 3.4.8 Asbestos-Free Product Installation

§ 3.4.8.1 It is hereby understood and agreed that no product and/or material containing asbestos, including chrysolite, amosite, crocidolite, tremolite asbestos, anthorphyllite asbestos, actinolite asbestos and any combination of these materials that have been chemically treated and/or altered shall be installed or introduced into the Work by the Contractor or its employees, agents, Subcontractors, or other individuals or entities over whom the Contractor has control. The Contractor shall be required to provide a signed certification statement ensuring that all products or materials installed or introduced into the Work will be asbestos-free.

§ 3.4.8.2 The Contractor also shall be required to furnish certified statements from the manufacturers of supplied materials used during construction verifying their products to be asbestos-free in accordance with the requirements of Section 3.4.8.1.

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§ 3.4.8.3 The Contractor shall complete and submit to the Owner a certification evidencing asbestos-free product installation prior to issuance of the final Certificate for Payment in a form acceptable to the Owner.

§ 3.4.9 Asbestos may be present within the construction areas. Contractors are to become aware of Owner's hazardous material report prior to construction. Work is not to disturb any in-place hazardous materials. The Contractor must immediately stop all Work and notify the Owner if it reasonably suspects the presence of unknown hazardous materials and/or has disturbed any materials reasonably suspected to be hazardous materials.

§ 3.5 Warranty

§ 3.5.1 ~~The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective.~~ In addition to any other warranties, guarantees, or obligations set forth in the Contract Documents or applicable as a matter of law, and not in limitation of the terms of the Contract Documents, the Contractor warrants and guarantees that:

- .1 The Owner will have good title to the Work and all materials and equipment incorporated into the Work and, unless otherwise expressly provided in the Contract Documents, will be new.
- .2 The Work and all materials and equipment incorporated into the Work will be free from all defects, including any defects in workmanship or materials.
- .3 The Work and all materials and equipment incorporated into the Work will be merchantable at the time of installation.
- .4 The Work and all materials and equipment incorporated into the Work will conform in all respects to the Contract Documents in the reasonable judgment of Architect.

The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. ~~If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.~~

Upon notice of the breach of any of the foregoing warranties or guarantees or any other warranties or guarantees under the Contract Documents, the Contractor, in addition to any other requirements in the Contract Documents, will commence to correct such breach within 72 hours after written notice thereof and thereafter will use its commercially reasonable best efforts to correct such breach to the satisfaction of the Owner; provided that if such notice is given after final payment hereunder, such 72 hour period shall be extended to seven (7) days. The foregoing warranties and obligations of the Contractor shall survive the final payment and/or termination of the Contract.

The Contractor shall, at the time of final completion of the Work and as a condition precedent to final payment to the Contractor, assign to the Owner all manufacturers' warranties related to the materials and labor used in the Work. The Contractor further agrees to perform the Work in such manner as to preserve any and all such manufacturers' warranties and deliver to the Architect the warranties, project manuals, operating procedures, and other materials related to each of the building systems and materials included in the Contractor's Work and as required by the Specifications.

Notwithstanding anything contrary in the foregoing or in any other Contract Document(s), labor shall be warranted for one year, commencing as of the date specified in the Architect's Certificate of Substantial Completion, and the manufacturer warranties applicable to the materials integrated into the Work shall commence and end as provided in the such warranty documents, provided to Owner in accordance with this Section 3.5.1.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor shall pay all local, state and federal taxes levied on its business, income or property and

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shall make all contributions for social security and other wage or payroll taxes. The Contractor shall be solely responsible for such payments and shall indemnify the Owner and hold it harmless from same.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 ~~Unless otherwise provided in the Contract Documents, the~~ The Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work ~~knowing it to be~~ contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide written and dated notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Owner and Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, they will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the ~~Architect determines~~ Owner and Architect determine that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the ~~Owner and Contractor,~~ Contractor in writing, stating the reasons. If ~~either party~~ Contractor disputes the ~~Architect's~~ determination or recommendation, ~~that party may~~ the Contractor shall submit a Claim as provided in Article 15. The requirements of Section 2 of 1998 PA 57, as amended, are hereby incorporated into this document. The Contractor shall be alert to any indication or evidence of existing underground or concealed utilities or structures not shown on the Contract Documents and shall immediately notify the Owner of discovery of such evidence. If the Contractor encounters such utilities or structures, it shall cease operations immediately to minimize damage and shall notify the Owner and Architect. The Contractor shall bear the cost of damage resulting from its failure to exercise reasonable care in its construction activity or from continuing operations without notifying the Owner.

§ 3.7.4.1 The Contractor bidding on the Work is responsible for visiting the site and determining all local conditions, except those that are hidden or unknown, that may in any way affect its Work.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall ~~notify~~ provide written and dated notification to the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features ~~may be made~~ shall be made, as needed, as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

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.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs ~~are more than or less than~~ differ from allowances, the Contract Sum ~~shall~~ may be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The superintendent shall be satisfactory to the Owner in all respects, and the Owner shall have the right to require the Contractor to remove any superintendent from the Project whose performance is not satisfactory to the Owner and to replace such superintendent with a superintendent who is satisfactory to the Owner.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Owner and/or the Architect may notify the Contractor, stating whether the Owner ~~or~~ and/or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. ~~Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.~~

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's ~~consent, which shall not unreasonably be withheld or delayed.~~ consent .

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits ~~current under the Contract Documents.~~ required under the Contract Documents or any scheduling updates issued by the Architect or Owner. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. In no event shall the Contractor's Construction Schedule be extended due to action or inaction of the Contractor, except with prior written approval of the Owner within the Owner's sole discretion.

The Contractor shall cooperate with the Architect and Owner in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other contractors or the construction or operations of the Owner's own forces. The Contractor acknowledges and understands that the work schedule will be modified from time-to-time with the Owner's approval to coordinate with the work of others and that such schedule changes do not give rise to a claim for damages or additional compensation by the Contractor for delay or otherwise. The Contractor shall be required to conform to the most recent Owner-approved schedule and acknowledges that fact was taken into account when it agreed to the Contract Sum and entered into this Contract.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the ~~Architect's approval. The Architect's approval~~ Owner's and Architect's approval. The Owner's and the Architect's approvals shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, ~~and (2) allow the Architect reasonable time to review submittals.~~ (2) allow for a reasonable amount of time to review submittals, and (3) shall provide for expeditious and practical execution of the Work. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent ~~schedules submitted to the Owner and Architect.~~approved Project schedules and the most recent Work schedule submitted to the Owner and Architect consistent therewith.

§ 3.10.4 Progress Meetings: Meetings of representatives of the various Contractors may be held for the purpose of coordination and furthering the progress of the Work. Contractor and Subcontractor attendance is mandatory. Meetings shall be held at regular intervals as provided in the General Requirements; special meetings may be held if deemed necessary by the Owner and/or Architect.

§ 3.10.5 The Contractor shall proceed strictly (not substantially) in accordance with the critical path set forth in the Construction Schedule. The Contractor shall monitor the progress of the Work for conformance with the requirements of the Construction Schedule and shall promptly advise the Owner of any delays or potential delays. If any progress report indicates any delays, the Architect shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment of the Contract Time or any Milestone Date or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to a Change Order.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor for submittal to and review by the Architect to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor for submittal to and review by the Architect to illustrate materials or equipment for some portion of the Work. All Work shall be furnished and installed in accordance with the Drawings, Specifications, and as additionally required by the manufacturer's printed instructions. The Contractor shall review the manufacturer's instructions, and where conflict occurs between the Drawings or Specifications and the manufacturer's instructions, the Contractor shall request clarification from the Architect prior to commencing the Work.

§ 3.12.3 Samples are physical examples for submittal to and review by the Architect that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

The Contractor agrees to ensure that its first submissions shall comply with all the requirements of the Contract Documents. It is further agreed that if any Shop Drawing, Project Data, Sample, or similar submittals require excessive submissions to secure the approval of the Architect due to the Contractor's failure to comply with specified

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products, resulting in delays or excessive reviews by the Architect, the Contractor will be held responsible for delays, added review costs, and damages to the Owner caused by such delays. Without limiting the foregoing, the Contractor's obligation to hold the Owner harmless from and bear the costs for any delay, good faith rejection of or resulting from any Shop Drawing, Project Data, Sample or similar submittal by Architect provided such delay or rejeetion is eonditioned on such delay or rejection being attributable to a negligent act or omission of Contractor.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's review and approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect in detailed writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. ~~The~~ Subject to its professional skill and expertise, the Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

~~The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.~~**§ 3.13.1** The Contractor shall confine operations at the site to areas

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permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 Anything contained in the Contract Documents to the contrary notwithstanding, no one except the Owner shall be permitted to disrupt the operation of any building system or any other services without the Owner's prior written consent. Any request to perform such work shall be in writing, received by the Owner no less than five (5) days prior to the commencement of the requested disruption, and shall detail (1) the exact nature and duration of such interruption, (ii) the area affected, and (iii) any impact upon the Construction Schedule caused by such proposed temporary disruption. Unless otherwise approved by the Owner, all work shall be performed during the hours and on the days set forth in the Specifications, in accordance with the most-recent project schedule, and/or as directed by the Owner or Architect. The Contractor's failure to comply with the notice provisions of this section shall constitute a waiver by the Contractor of any right it may have to an adjustment of the Contract Time, on account of any postponement, rescheduling, or other delays ordered by the Owner in connection with any Work for which appropriate notice was not furnished.

§ 3.13.3 The Contractor will consult with the Owner and the Architect concerning any necessary operations at the Project site, including staging area limits, office or storage trailer locations, dumpster operations, equipment and material deliveries, hoisting areas and any other construction impacts on the Owner's grounds.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor and its Subcontractors, under the Contractor's direction, shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 Any areas and/or concurrently occupied space both occupied by the Owner and used in the progress of the Work, both within the limits of the construction site and the adjacent areas leading to it, shall be maintained, opened to travel and kept in a clean condition. Failure by the Contractor to maintain said areas will result in the Owner's cleaning of same, at the expense of the Contractor.

§ 3.15.4 In addition to removal of rubbish, the Contractor and its Subcontractors, under the Contractor's direction, shall replace any broken glass, remove stains, spots, marks, and dirt from decorated work, clean hardware, and/or remove spots and smears from all surfaces which were affected by the Work.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall indemnify and hold harmless the Owner and Architect ~~harmless from~~ from any and all cost, damages, or loss on account thereof, including, but not limited to, actual attorneys' fees, but shall not be

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responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect. The review by the Owner or Architect of any method of construction, invention, appliance, process, article, device or materials of any kind shall be for its adequacy in the Work and shall not be an approval for the use thereof by the Contractor in violation of any patent or other rights of any third person.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, the Owner's Board of Education, its board members, administration, its successors, assigns, Architect, Architect's consultants, and agents and employees of any of them (the "Indemnitees") from and against any and all claims, costs, damages, losses, liabilities, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the ~~Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the~~ Work ~~itself), but only~~ to the extent caused in whole or in part by (i) the negligent acts or omissions of the Contractor, ~~a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder.~~ its officers, directors and employees, agents or subcontractors; (ii) any breach of the terms of the Contract Documents by the Contractor; or (iii) any breach of any representation or warranty by the Contractor under the Contract Documents. The Contractor shall notify the Owner by certified mail, return receipt requested, immediately upon knowledge of any claim, suit, action, or proceeding for which the Owner or one or more of the Indemnitees may be entitled to indemnification under the Contract Documents. Further, the Owner shall be entitled to recover attorneys' fees and legal fees from the Contractor under the following eireumstances: (1) the Owner has to defend a third-party claim or action for which the Contractor must indemnify the Owner as described above; and (2) the Owner successfully asserts a claim or action against the Contractor for professional negligence, breach of contract, and/or defective Work. For purposes of the previous sentence "successfully" means the Owner recovers damages from the Contractor, regardless of amount. The Contractor shall not be responsible for indemnifying an Indemnitee for the Indemnitee's negligence, but shall remain responsible to the fullest degree of Contractor's fault, on a comparative basis. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In ~~claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.~~addition to and not in limitation of the Contractor's other indemnity obligations, the Contractor hereby accepts and assumes exclusive liability for and shall indemnify, protect, and hold harmless the Owner and Architect from and against the payment of the following:

- **.1** all contributions, taxes, or premiums (including interest and penalties thereof) which may be payable under the unemployment insurance law of any state, the federal Social Security Act, federal, state, county, and/or municipal tax withholding laws, or any other law, measured upon the payroll of or required to be withheld from employees by whomsoever employed, engaged in the Work to be performed and furnished under this Contract;
- **.2** all sales, use, personal property and other taxes (including interest and penalties thereof) required by any federal, state, county, municipal, or other law to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person or persons acting for, through or under it or any of them, by reason of the performance of the Work or the acquisition, ownership, furnishing, or use of any materials, equipment, supplies, labor, services, or other items for or in connection with the Work; and
- **.3** all pension, welfare, vacation, annuity, and other benefit contributions payable under or in connection with respect to all persons by whomsoever employed, engaged in the Work to be performed and furnished under this Contract.

Provided Owner or Architect has, in good faith and to the best of their knowledge, provided Contractor with complete, accurate, reports identifying the presence of any and all hazardous materials on Site as of the date of commencement of the Work, Contractor shall indemnify, defend, and hold the Owner harmless from any claim, damage, loss or

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expense, including, but not limited to, actual attorney fees, incurred by the Owner related to any hazardous material, condition or waste, toxic substance, pollution, or contamination brought into the Project site or caused or exacerbated by the Contractor or used, handled, transported, stored, removed, remediated, disturbed, or dispersed of by Contractor.

§ 3.18.3 In the event that any claim is made or asserted, or lawsuit filed for damages or injury arising out of or resulting from the performance of the Work, whether or not the Owner or Architect is named as a party, the Contractor shall immediately advise the Owner and Architect, in writing, of such claim or lawsuit and shall provide a full and complete copy of any documents or pleadings thereto, as well as a full and accurate report of the facts involved.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement. The Term "Architect," "Architect/Engineer," "Engineer," or "Design Professional" as used herein means the Architect or the Architect's authorized representative.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the ~~Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.~~Owner and Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for ~~Payment.~~ Payment and with the Owner's written concurrence during the correction period. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or ~~as otherwise agreed with the Owner, to become generally~~ more frequently as agreed with the Owner or required by law, to become familiar with the progress and quality of the portion of the Work completed, and to determine ~~in general~~ if the ~~Work observed is being performed in a manner indicating that the~~ Work, when fully completed, will be in accordance with the Contract Documents. ~~However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The~~ Except as otherwise set forth herein or in the Owner/Architect Agreement, the Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents. The Architect shall provide all services and duties that may be performed by an "Architect" or "Engineer" in 1937 PA 306 and 1980 PA 299, including but not limited to supervision of construction.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner ~~reasonably~~ informed about the progress and quality of the portion of the Work completed, will guard the Owner against defects and deficiencies in the Work, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. ~~The~~ Except as required by the Owner/Architect Agreement or other Contract Documents, the Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and, except as provided in the agreement between Owner and Architect or this document, will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. The Architect shall provide all services and duties that may be performed by an "Architect" or "Engineer" in 1937 PA 306 and 1980 PA 299, including but not limited to supervision of construction.

§ 4.2.4 Communications

The Owner and Contractor shall endeavor to include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise ~~relating to~~ materially affecting the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Owner and Architect or, in the absence of an approved submittal schedule, with reasonable promptness as to cause no delay in the Work while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. However, should the Architect discover during the course of such review any inaccuracies, incompleteness, or other irregularities, the Architect shall immediately notify the Owner of the same to determine an appropriate corrective course of action or notify the Contractor of the same to correct the irregularities.

§ 4.2.8 The Architect will ~~prepare~~ review and recommend for approval Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to ~~determine~~ determine, with the Owner's concurrence, the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site.~~The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.~~

§ 4.2.11 The Architect will interpret ~~and decide~~ matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable ~~promptness.~~promptness given the particular circumstances.

§ 4.2.12 Interpretations ~~and decisions~~ of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such ~~interpretations and decisions,~~ interpretations, the Architect will endeavor to secure faithful performance by ~~both Owner and~~ Contractor, ~~will not show partiality to either,~~ and will not be liable for results of interpretations or decisions rendered in good ~~faith.~~faith and without negligence.

§ 4.2.13 The Architect's ~~decisions~~ interpretations on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with

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reasonable ~~promptness.~~ promptness given the particular circumstances. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor. The term "Subcontractor" shall also include Sub-subcontractors at any tier and material and equipment suppliers. Each and every subcontract shall be understood to have the Owner as a third-party beneficiary, and the Owner shall enjoy all third-party beneficiary rights permitted by law.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract ~~Documents,~~ Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect in writing of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. ~~Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.~~ All contractual agreements with additional persons or entities serving as a Subcontractor or supplier shall expressly identify the Owner as a third-party beneficiary, and the Owner shall enjoy all third-party beneficiary rights not prohibited by law.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, despite the Architect's or Owner's reasonable objection, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. The Contractor shall notify the Owner and Architect of any proposed substitution a minimum of ten (10) days prior to such proposed change.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the

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proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work that is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and ~~Contractor;~~ Contractor in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation ~~shall be equitably adjusted for increases in cost resulting from the suspension.~~may be adjusted as negotiated by the parties.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.~~If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation. The Contractor shall be responsible for coordinating the Work with the work of other Contractors, including the Owner's own forces or Separate Contractors, so as to complete the Work in accordance with the Project time schedule.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 ~~Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.~~**NOT USED.**

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly

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notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not ~~apparent.~~ reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's ~~delays, improperly timed activities,~~ damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor ~~wrongfully~~ causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and ~~the Architect will~~ allocate the cost among those responsible. The Owner's right to clean up shall in no event be deemed a duty, and should the Owner choose not to pursue this remedy, the Contractor necessitating such action shall remain fully responsible for the same.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, only by Change Order, Construction Change ~~Directive~~ Directive, written contract amendment, or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive ~~requires agreement~~ may be issued by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Unless expressly stated otherwise in the Change Order, an agreement on any Change Order shall constitute the Contractor's final position on all matters relating to the change in the work that is subject to the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in

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the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one or more of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

However, the Contract Time shall be adjusted only if the Contractor demonstrates to the Owner that the changes in the Work required by the Construction Change Directive adversely affect the critical path of the Work.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall ~~determine~~ determine, with the Owner's approval, the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to ~~the following:~~a reasonable amount of the following that are actually incurred by the Contractor:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- **.2** Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- **.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- **.5** Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. Contractor agreements to a Construction Change Directive shall require a follow-up writing or signature as contemplated in Section 7.3.7.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for undisputed Work completed under the Construction Change Directive in Applications for Payment. ~~The~~ For those undisputed portions, the Architect will make an interim determination for purposes of

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monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of ~~cost~~ cost, if agreed to by the Owner in writing, shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of ~~either party~~ the Contractor to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree in writing with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the ~~adjustments,~~ adjustments in writing, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 In no event shall the Contractor be entitled to receive, and the contractor hereby waives the right to receive, any payment or any extension of time for additional or changed work, whether partially or fully completed or simply proposed, unless such additional work is authorized by a written Change Order or Construction Change Directive signed by the Owner, nor shall the Contractor be obligated to proceed with any such work. Only the Owner shall have the right to issue a written Change Order or Constructive Change Directive to the Contractor authorizing an addition, deletion or other revision in the scope of the Work and/or an adjustment in the Contract Sum or the Construction Schedule.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall either (i) file a Claim in accordance with Article 15 and continue to implement the change in the Work, or (ii) notify the Owner and Architect in writing and shall not proceed to implement the change in the Work. ~~If~~ Without limiting other restrictions on payment, if the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for obtaining all supplies, materials, tools and equipment necessary to perform the Work and for properly performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. All work shall be completed in sufficient time to allow for clean-up and preparation for Owner move-in prior to the Date of Substantial Completion.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 ~~If~~ Provided the Contractor submits a written request for an extension not more than fourteen (14) days after the occurrence that gives rise to the delay, if the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by ~~labor disputes, fire, unusual delay in deliveries,~~ fire, government-declared

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emergencies, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending ~~mediation and binding dispute resolution;~~ litigation, mediation, arbitration or binding dispute resolution, as applicable; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may ~~determine.~~
determine and with which the Owner agrees. Failure of the Contractor to submit a timely request for an extension shall irrevocably waive the Contractor's right to such an extension of time. If the Contract Time is subject to extension pursuant to this subparagraph, the Contractor shall receive such an extension, and subject to Owner review and written approval, may receive extension costs related to Construction Management staff and GC costs.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents. Only upon Owner review and written approval, the Contractor may receive extension costs related to Construction Management staff and GC costs..

§ 8.4 Delay Damage Claims

§ 8.4.1 In the absence of a delay caused by something outside the Contractor's reasonable control, if the Contractor fails to complete its Work on time resulting in loss or damage to the Owner, whether or not liquidated damages are called for in the Contract Documents, the Owner shall be entitled to make a Claim for direct damages caused by the Contractor's delay.

§ 8.4.2 In the event the Contractor is hindered in the commencement or progress of the Work for any reason by someone other than the Owner, and in the event the Contractor claims damages as a direct and proximate consequence thereof (including, but not limited to, extended general conditions, overhead, profit, overtime, interest, supervision or other costs or profits whatsoever), then the Contractor shall only assert claims against the Owner related to extended general conditions and costs of paying staff.

For any delay claims raised against the Owner for any reason, the Contractor's sole and exclusive remedy is an extension of time to perform the Work not to exceed the time frame of any proven delay. Under no circumstances is the Contractor entitled to monetary delay damages from the Owner.

§ 8.4.3 Notwithstanding the foregoing, in the event of any delay in the completion of the Contractor's Work or scheduling of the Contractor's Work, including the sequence of that Work which is attributable to the Owner, and if it is determined by a court of competent jurisdiction that the Owner is liable for such delay despite the other terms of this Contract barring any Owner liability for damages for delay, then the Owner shall be liable to the Contractor for liquidated damages in the amount of not to exceed One Hundred Dollars ($100) per day, maximum, which shall include all of the Contractor's claims, including by way of example, delays, compressions of schedule, lost productivity, lost profits, lost opportunities, out of sequence work, overhead, crowding, tools, equipment, rentals, etc.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

~~Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the~~ The Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Owner or Architect may require, and unless objected to by the Owner or Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

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§ 9.2.1 The schedule of values shall be prepared in such manner that the value associated for each major item of work and each subcontracted item of work is shown with materials and labor indicated separately on AIA Document G702 - Application and Certificate of Payment, and AIA Document G703 - Continuation Sheet, or otherwise.

§ 9.3 Applications for Payment

§ 9.3.1 At least ~~ten~~ fifteen (15) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of ~~values, if required under Section 9.2,~~ values for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents. The form of Application and Certificate for Payment shall be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet, unless otherwise agreed by the Owner. Applications for Payment are due to the office of the Architect by the designated day of the month. Applications for Payment that are received after the specified date will not be processed until the following month.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders. A request for payment of sums related to work regarding Construction Change Directives shall, unless qualified in writing at the time of request, constitute full and complete consent to the Construction Change Directive(s) and to the issuance of a Change Order.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Contractor shall submit with each monthly Application for Payment (1) an Affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the previous application was submitted and for which the Owner might in any way be responsible have been paid or otherwise satisfied, and (2) a release or waiver of liens arising out of the Contract from each Contractor and/or Subcontractor, materialman, supplier and laborer for the Contractor addressing all previous Applications for Payment submitted for the Project.

§ 9.3.1.4 The Contractor must provide copies of the insurance certificates, bonds, and the same for all of the Subcontractors prior to submitting the first Application for Payment.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. Payment to Contractor for materials stored off site is discouraged. When circumstances indicate that the Owner's best interest is served by off-site storage, the Contractor shall make written request to the Owner for approval to include such material costs in the next progress payment. The Contractor's request shall include the following information:

.1 A list of the fabricated materials consigned to the Project (which shall be clearly identified, giving the place of storage, together with copies of invoices and reasons why materials cannot be delivered to the site.

.2 Certification that items have been tagged for delivery to the Project and that they will not be used for another purpose.

.3 A letter from the Contractor's Surety indicating agreement to the arrangements and that payment to the Contractor shall not relieve either party of their responsibility to complete the Work.

.4 Evidence of adequate insurance covering the material in storage, which shall name the Owner as additionally insured.

.5 Costs incurred by the Architect to inspect material in off-site storage shall be paid by the Contractor.

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.6 Subsequent pay requests shall itemize the materials and their cost which were approved on previous pay requests and remain in off-site storage.

.7 When a partial payment is allowed on account of material delivered on the site of the Work or in the vicinity thereof or under possession and control of the Contractor, but not yet incorporated therein, such material shall become the property of the Owner, but if such material is stolen, destroyed or damaged by casualty before being used, the Contractor will be required to replace it at its own expense.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in aeeordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for eonformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the ~~Architect. However,~~ Architect, in writing, together with the certification to which it pertains. However, unless otherwise required by the Owner/Architect Agreement, any other Contract Document, or applicable law, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum. Nothing in this Section 9.4.2 shall be interpreted to reduce or eliminate the Architect's duties as set forth in Section 3.1.9 of the Owner/Architect Agreement, including supervision of construction.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not ~~remedied;~~remedied, or the Contractor is in default on the Agreement;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a Separate Contractor;

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.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;~~or~~

.7 ~~repeated~~ failure to carry out the Work in accordance with the Contract ~~Documents.~~ Documents;

.8 the Work not having progressed to the extent set forth in the Application for Payment;

.9 representations of the Contractor are untrue;

.10 failing to conform to Project Schedule;

.11 default in the performance of any obligation to the Owner under another contract; or

.12 failure to provide sufficiently skilled workers.

§ 9.5.2 When ~~either party~~ the Contractor disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, ~~that party~~ the Contractor may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.5.5 If the Contractor disputes any determination by the Owner or Architect with regard to any Certificate for Payment, the Contractor shall nevertheless continue to expeditiously perform the Work and such dispute shall provide no basis for any manner of suspension of the Contractor's performance of the Work.

§ 9.5.6 Notwithstanding anything herein to the contrary, the Owner has no obligation to pay the Contractor absent receipt of a Certificate for Payment for the requested amount, and neither the Architect's failure to issue a Certificate for Payment nor the Architect's failure to notify the Contractor and/or Owner of a withheld Certificate for Payment creates an obligation on the Owner to pay the Contractor. The foregoing sentence shall not operate to limit the right of the Owner to dispute amounts requested by the Contractor or to withhold payments from the Contractor as provided in the Contract Documents.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The ~~Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.~~Owner may, in its sole discretion, after providing Contractor with ten (10) days prior written notice, make direct payments to the Contractor's Subcontractors, suppliers, laborers or claimants relating to labor or material provided to the Contractor for which the Contractor has not provided a waiver of lien, in the event the Subcontractors, suppliers, laborers or claimants threaten to or actually cease providing labor and/or materials for the Project such that, in the Owner's determination, progress of the Project and the Project's Schedule are jeopardized. All payments made

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pursuant to this section shall be considered the same as if paid directly to the Contractor and shall constitute partial payment of the Contract Sum. In the event the Contractor disagrees with the amount proposed to be paid to one or more Subcontractors, suppliers, laborers or claimants, the Contractor shall provide a bond in the amount the Contractor believes the Owner will overpay, within ten (10) days of receipt of notice, or be barred from making any claim that the amount of the direct payment was incorrect. Payment under this provision shall not jeopardize any other remedy available to the Owner.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 Subject to applicable law, if a petition in bankruptcy or any other arrangement or proceeding regarding insolvency, assignment for the benefit of creditors, trust, chattel mortgage, or similar state or federal proceeding, whether voluntary or involuntary, shall be filed with respect to the Contractor, the Owner may withhold the final balance, or any other payments, whether or not an application for progress payment has been properly filed, until expiration of the period of any guarantees or warranties required for the Contractor, and the Owner may pay out such funds the amount necessary to satisfy any claims or costs that otherwise would have been covered by such guarantees or warranties.

§ 9.7 Failure of Payment

If ~~the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if~~ without justifiable basis under the Contract Documents, including these General Conditions, the Owner does not pay the Contractor within seven days after the date established in the Contract ~~Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days'~~ Documents the undisputed amount asserted by the Contractor in its Application for Payment or awarded by a court, then the Contractor may, upon twenty-one (21) additional days' written notice to the Owner and Architect, stop the Work until payment of the undisputed amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents. The Contractor acknowledges the Owner's right to dispute in good faith any amount requested by the Contractor, and, irrespective of the Architect's issuance of a Certificate for Payment, the Owner's right to withhold payments from the Contractor, including, without limitation, to correct Work that fails to conform with the Contract Documents or as an offset or recoupment to recover the cost of damages incurred by the Owner due to the Contractor's breach of the Contract or a wrongful or negligent act or omission of the Contractor.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents and when all required occupancy permits, if any, have been issued, so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of

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items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item ~~upon notification by the Architect.~~ immediately. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.6 Notwithstanding Sections 9.8.1 and 9.8.2, as a condition precedent to establishing the date of Substantial Completion, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected (a "punch list"). The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Should the Contractor fail to make corrections in a timely fashion, but not later than fifteen (15) calendar days from the date of Substantial Completion or notification of the required corrections, whichever is earlier, such Work may be corrected by the Owner at the Contractor's sole expense, and any remaining payments due the Contractor shall be withheld by the Owner.

§ 9.8.7 The Contractor shall promptly notify the Architect, in writing, when the Work deficiencies and/or punch list items are completed. Upon the review of the Work by the Architect after such notification by the Contractor, if Work deficiencies and/or punch list items shall continue to exist, the Contractor shall reimburse the Owner its cost plus ten percent (10%) overhead and profit on any cost incurred by the Owner, including the Architect's fees for re- inspection of the Work. Failure to pay such costs within ten (10) days of receipt of a demand regarding the same shall permit the Owner to pay such costs out of retainage held by the Owner on the Contractor's contract.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.9.4 Any agreement as to the acceptance of non-conforming Work not complying with the requirements of the Contract Documents shall be in writing in the form of a Change Order, acceptable to the Owner's authorized representative and signed by all parties.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, ~~and (6)~~ (6) an affidavit that states the Work is fully completed and performed in accordance with the Contract Documents, (7) in the event of Contractor bankruptcy, at the Owner's option, an order entered by the court having jurisdiction of the Contractor's insolvency proceeding authorizing such payment, (8) a general release executed by the Contractor on a form provided by the Architect, (9) all close-out documents, (10) all warranties collected and provided in an acceptable manner, and (11) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and ~~reasonable~~ actual attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising ~~from~~from:

.1 ~~liens, Claims, security interests, or encumbrances arising out of the Contract~~ Claims already asserted as of the date of final payment and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents and resulting demands and Claims asserted in accordance with the Contract Documents;

.3 terms of ~~special~~ all warranties required by the Contract ~~Documents;~~ Documents or provided at law or in equity; or

.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of ~~claims by that payee except those previously made in writing and identified by that payee~~ all claims of the Contractor except those previously made by the Contractor in writing, including Claims pending as of the final payment date, or

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identified by the Contractor as unsettled at the time of final Application for ~~Payment.~~Payment and specifically referenced as being an exception to the waiver contained in this section.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall continuously maintain adequate protection of all Work from damage and shall protect the Owner's property from injury or loss. The Contractor shall make good any such damage, injury or loss at no cost to the Owner, except to the extent directly caused by agents or employees of the Owner. The Contractor shall adequately protect the Work and adjacent property as required by law, the Contract Documents, or as otherwise required, to cause no damage to the Work and adjacent property during the execution of the Work. This requirement shall also apply to structures above and below ground as conditions of the site require. The Contractor shall also provide recommendations and information to the Owner regarding (a) the assignment of responsibilities for safety precautions and programs by the Subcontractors and responsibilities for safety precautions and programs by the Subcontractors and the Owner for the safety of the Owner, and the general public; (b) temporary facilities; and (c) equipment, materials and services for common use of Subcontractors. The Contractor shall verify that the requirements and assignment of responsibilities are included in the proposed Contract Documents.

§ 10.1.2 The Contractor is solely responsible to the Owner for safety at the Project site and, accordingly, shall be solely responsible for initiating, monitoring, maintaining and supervising all safety precautions and programs in connection with the performance of the Work. The foregoing does not relieve the Subcontractors of their responsibility to the Contractor for the safe performance of their Work in accordance with all applicable laws.

§ 10.1.3 The Contractor shall develop and implement a safety plan that complies with all applicable laws covering all activities on the Project Site except those activities performed solely by the Owner. The Contractor shall provide the Owner a copy of such health and safety plan prior to commencement of Work. The Owner shall have no duty to review the plan and shall assume no duty by doing so.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take ~~reasonable precautions~~ every reasonable precaution for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall ~~comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.~~take all reasonable safety precautions with respect to its Work and work of others, shall comply with all standard industry safety measures and shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority and all other requirements of the Contract Documents, including those applicable to the safety of persons or property. The Contractor shall be responsible for the safety of all of the Contractor's employees and the safety of all of the Contractor's Subcontractors, suppliers, and their employees. The Contractor shall report in writing to the Architect any injury to any of Contractor's or its Subcontractor's employees at the site within one (1) day after the occurrence of such injury.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, ~~reasonable~~ reasonable, necessary and appropriate safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. The Contractor shall be solely and fully responsible for any and all damage claims and for defense of all actions against the Owner relating to such explosives, hazardous materials and/or unusual methods.

§ 10.2.5 The Contractor shall promptly remedy damage and loss ~~(other than damage or loss insured under property insurance required by the Contract Documents)~~ to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If ~~either party~~ the Contractor suffers injury or damage to person or property because of an act or omission of the ~~other party,~~ Owner, or of others for whose acts ~~such party~~ the Owner is legally responsible, written notice of the injury or damage, whether or not insured, shall be given to the ~~other party~~ Owner within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the ~~other party to investigate the matter.~~ Owner to investigate the matter. This provision shall be for investigative purposes only and shall not eliminate or reduce a party's obligation to pursue Claims. The Contractor's failure to do so shall be an irrevocable waiver of any Claim arising out of such injury or damage. Injury or damage to persons or property suffered by the Owner because of an act or omission of the Contractor, or others for whose acts the Contractor is legally responsible, shall be subject to the limitation periods established by Michigan law.

§ 10.2.8.1 The Contractor causing damage to the Work of another shall be responsible for the repair and replacement of such damaged Work. Back charges shall be made against the Contract Sum of the damaging Contractor when corrections are not made promptly.

§ 10.2.8.2 If the Contractor or any Subcontractor chooses to use any systems, equipment, facilities, or services which have been incorporated in the Project as a permanent part thereof by any other, the Contractor shall assume full responsibility for damages caused to said systems, equipment, facilities or services, and have damages repaired as required, so that in no case will the performance of the used systems, equipment, facilities or services be diminished from the specified criteria as a result of such use.

§ 10.2.9 The Contractor acknowledges that the safety of the Owner's students, employees and guests is of the utmost importance. The Contractor will take no action which would jeopardize the safety of the Owner's students, employees and guests and, without the Owner's written approval, shall take no action which would interfere with the Owner's activities. Without limiting the foregoing sentence, the Contractor shall comply with all laws applicable to student and/or school safety.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 ~~The~~ To the extent specified in the Contract Documents, the Contractor is responsible for compliance with any requirements ~~included in the Contract Documents~~ regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the

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Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect in writing of the condition.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. ~~The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection.~~ When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional ~~costs of~~ costs, as they relate to payment of staff and extended general conditions, to address shutdown, delay, and start-up.

§ 10.3.3 To the ~~fullest~~ extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the ~~site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.~~site. To the extent the Contract Documents require the removal, transport and disposal of hazardous materials, the Contractor agrees that it assumes responsibility for said tasks as part of the Contract.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence or attributable fault of any kind on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's reasonable discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7. Nothing in this paragraph will be construed as relieving Contractor from the cost and responsibilities for emergencies covered hereby.

§ 10.5 Notification of Utility Companies

§ 10.5.1 At least five (5) working days prior to the start of work in areas which may involve existing utility lines, the Contractor shall notify the MISS DIG notification system, as legally required and, if applicable, any Registered Utility Protection Service of the utility company possibly affected by the planned work by certified mail with return receipt requested.

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§ 10.5.2 The utility company should, upon receipt of notice, stake, mark or otherwise designate the location (and depth) of their lines, or temporarily move the line(s). The Contractor shall wait for the applicable utility to stake and/or mark its utility lines before commencing the relevant Work

§ 10.5.3 The Contractor shall immediately report to the respective utility company any break or leak in its lines, or any dent, gouge, groove or other damage to the utility line or to its coating or cathodic protection made or discovered in the course of the Work.

§ 10.5.4 The Contractor shall immediately alert the Owner, Architect and occupants of nearby premises of any and all emergencies caused or discovered in the utility line(s) in the course of the Work.

§ 10.6 Security

§ 10.6.1 All construction participants, including the Contractor, Architect, Subcontractors, etc., shall cooperate with the Owner's security personnel and shall comply with all of the Owner's security requirements. Such requirements shall include, without limitation, if requested by the Owner, delivering to the Owner's security personnel, prior to the commencement of the Work on each day, a list of all personnel who will be permitted access to the Work. The foregoing, however, shall not relieve the Contractor of any obligation to provide a safe and secure workplace for all parties entering the Project Site. The Contractor shall be responsible to implement commercially reasonable data security protection measures to protect the Owner's networks and data when performing technology-related Work.

§ 10.7 Fire Protection

§ 10.7.1 The Contractor shall maintain free access to the building areas for firefighting equipment and shall at no time block off main roadways or fire aisles without providing adequate auxiliary roadways and means of entrance for firefighting equipment, including heavy fire department trucks, where applicable.

§ 10.7.2 The Contractor shall at all times cooperate with the Owner and kept the municipal fire department informed of the means of entrance and changes to the roadways or fire aisles as needed to provide fire department access to or around the Project Site.

§ 10.7.3 The Contractor shall, during the entire construction period and until the completion of the Work, provide and maintain all material, equipment, and services necessary for an adequate fire protection system, which shall meet the approval of the Owner and/or the Architect. The system shall, at a minimum, meet the requirements set forth in the Contract Documents and of applicable laws. These requirements shall be augmented and/or the installations relocated, as may be necessary to meet, at all time, the demands of adequate protection in all areas and shall not be reduced prior to the completion of the Work with the written approval of the Owner and/or the Architect.

§ 10.8 Environmental Statement and Responsibility of Contractors and Sub-Contractors

§ 10.8.1 It shall be the responsibility of the Contractor to pay any and all costs incurred in any way related to clean up related to any environmental hazard created by means of release, spill, leak or any other means of contamination caused by accident or negligence that is the responsibility of Contractor or its subcontractors or other agents.

§ 10.8.2 It shall be the responsibility of the Contractor to dispose of any product(s) and/or material in strict compliance with applicable federal, state, and local laws (e.g., Environmental Protection Agency, Michigan Department of Natural Resources, etc.).

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as required by law and as otherwise described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies rated A- or better by A.M. Best Company and lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The ~~Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents.~~ Owner hereby requires the Contractor to furnish bonds covering

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faithful performance of the Contract and payment of obligations arising thereunder, each in the penal sum of 100% of the Contract Sum and in accordance with applicable law, on the date of execution of the Contract. The Owner may also require, through the Contract Documents or otherwise, that any contract valued at $50,000 or less shall also include payment and performance bonds each in the penal sum of up to 100% of the Contract Sum. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located. The Contractor shall obtain and provide to the Owner copies of any and all bonds required by the Contract prior to Contractor beginning performance pursuant to the Contract. The Contractor's obligation to provide such bonds shall not be waived in any fashion, including any failure to secure such bonds prior to Contractor beginning performance pursuant to the Agreement.

§ 11.1.2.1 The Contractor's liability insurance shall be not less than the following:

.1	General Requirements		
	a. Worker's Compensation	-	Statutory
	b. Employer's Liability	-	$1,000,000 Each Accident
		-	$1,000,000 Each Employee
		-	$1,000,000 Policy Limit
.2	Comprehensive General Liability		
	a. Bodily Injury	-	$1,000,000 Each Occurrence
		-	$2,000,000 Aggregate
	b. Personal Injury	-	$1,000,000 Each Occurrence
		-	$2,000,000 Aggregate
.3	Automobile Liability		
	a. Bodily Injury	-	$1,000,000 Each Person
		-	$1,000,000 Each Occurrence
	b. Property Damage	-	$1,000,000 Each Occurrence
.4	Independent Contractors	-	$1,000,000 Each Occurrence
.5	Products and Complete Operations	-	$1,000,000 for one (1) year, commencing with issuance of final Certificate for Payment
.6	Contractual Liability	-	$1,000,000 Each Occurrence
.7	Asbestos Abatement Liability	-	$1,000,000 Per Claim
		-	$2,000,000 Aggregate
.8	Pollution	-	$1,000,000
.9	Umbrella Coverage	-	$4,000,000

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 ~~**Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.~~For all insurances for which the Contractor is obligated to have its insurance company name the Owner, Architect and Architect's consultants as additional insured, the Contractor shall require such insurance company to add to the policy the following clause: "The insurance afforded to the Additional Insured is primary insurance. If the Additional Insureds have other insurance which is applicable to the loss on an excess or contingent basis, the amount of the insurance company's liability under this policy shall not be reduced by the existence of such other insurance." Insurances provided on a "claims-made" basis shall be enforceable upon commencement of services and maintained for six years following substantial completion. Insurances provided on an "occurrence" basis shall be enforceable upon commencement of services and maintained for one year following substantial completion. Should the Contractor's insurance costs increase due to adding the Architect and/or Architect's Consultants as additional insureds, and should such costs be passed on to the Owner, the Architect and Architect's Consultants, as applicable, shall reimburse the Owner for such additional costs.

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§ 11.1.5 Notice of Cancellation or Expiration of Contractor's Required Insurance. Immediately after the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, but in no event less than the sooner of three (3) days after becoming aware or the coverage actually lapsing, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration, including the Contractor's plan to immediately procure replacement insurance as required by the Contract Documents to avoid any lapse in coverage. Contractor's failure to do so is a material breach of this Agreement, shall entitle the Owner to purchase replacement insurance at Contractor's sole cost, and shall subject the Contractor to any and all damages related to its failure to comply with its required insurance obligations. Further, upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right, but not the obligation, to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. This policy will exclude any tools, equipment, scaffolding, glass breakage, etc., owned or rented by the Contractor or Subcontractors and materials stored on the site, but not incorporated into the Project. The Contractor shall be responsible for protecting all product until the Date of Final Completion is established by the Architect/Engineer. The Contractor shall replace any Work if damaged before Final Completion. The Contractor may assume the risk itself or obtain insurance in amounts it deems sufficient.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may ~~delay commencement of the Work and may obtain insurance~~ obtain insurance of reasonable type and coverage amount that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the ~~Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~Work and the parties shall negotiate an adjustment to the Contract Sum and Contract Time. Property Insurance provided by the Owner will cover only Work incorporated into the construction and will not cover tools, equipment, or other property owned, leased, rented, or borrowed by the Contractor, Subcontractor, Sub-Subcontractor, or others.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the ~~Contractor;~~ Contractor and (2) the Contract Time and Contract Sum shall be ~~equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled.~~ negotiated. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 ~~The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages~~

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~~caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.~~All parties referenced in this General Conditions or otherwise related to this Project acknowledge and agree that the Owner is not waiving any rights its insurer(s) may have to subrogation. To the extent any term in the Contract Documents contrary to this provision, such term is void and unenforceable.

§ 11.3.2 ~~If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.~~**NOT USED.**

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss.~~The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

~~**§11.5 Adjustment and Settlement of Insured Loss**~~

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner. The Owner shall use its best efforts, with consultation of the Architect, to reach a quick and fair settlement for all interested parties, with the insurance companies after a loss.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article ~~15.~~15 if the Contractor timely and properly files a claim under Article 15.. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract ~~Time.~~Time or Contract Sum.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request with the Owner's consent to see such Work and it shall be uncovered by

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the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to ~~an equitable~~ a negotiated adjustment to the Contract Sum and Contract Time as may be appropriate. At the time the Owner's consent is sought as described herein, the Architect shall notify the Owner that additional costs may apply if the Work is in accordance with the Contract Documents. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

It is understood that the correction of work, either before or after Substantial Completion, shall occur without extension of the Contract Time, without increase in the Contract Sum, and without use of any contingency, unless the need for corrections is due to acts of the Owner, Architect, or others who are acting under the Owner's control.

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including work of other Contractors and Subcontractors, compensation of consultants, any delay or related damages, attorneys' fees incurred by the Owner, additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. The Owner shall have the right to charge the Contractor for any such costs and expenses and to deduct such amounts from any future payments due the Contractor.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. ~~During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.~~ If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 or other provisions of the Contract Documents establishing a "correction warranty" or other similar concept shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract ~~Documents.~~ Documents, including, without limitation, Section 3.5. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

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§ 12.2.6 The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Failure to correct Work deficiencies and/or punch list items in a timely fashion shall be a substantial breach, and the Owner may terminate the Contract immediately. The Owner's right of termination in this Section 12.2.6 is separate and distinct from the right of termination in Section 14.2. Whether or not the Contract is terminated, if the Contractor fails to make corrections in a timely fashion, such Work may be corrected by the Owner, in its sole discretion, at the Contractor's expense and the Contract Sum may be adjusted by back charge and/or withholding future payments due the Contractor accordingly. The Contractor shall promptly notify the Architect in writing when Work deficiencies and/or punch list items are completed. If upon review of the Work by the Architect, after such notification by the Contractor, Work deficiencies and/or punch list items shall continue to exist, the Contractor shall reimburse the Owner for any costs incurred by the Owner, plus ten percent (10%) overhead and profit, as well as the Architect's fees for reinspections of the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made. The acceptance of nonconforming Work by the Owner shall be by written Change Order signed by the Owner's authorized representative. Acceptance of nonconforming Work may only occur pursuant to such written Change Order.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the ~~place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.~~State of Michigan in all respects, except that Claims and causes of action for breach of the Contract Documents brought by the Owner shall not be deemed untimely if filed within six (6) years of Substantial Completion of the entire Project.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The ~~Owner~~ Contractor shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

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§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract ~~Documents,~~ Documents or applicable law, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located. For any late payments by the Owner, the interest rate shall not exceed five percent (5%) per annum (see MCL 438.31).

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days for reasons within the Owner's control and through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** ~~An act of government, such as a declaration of national emergency, that requires all Work to be stopped;~~
- **.3** Because the ~~Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the~~ Owner has not made payment on ~~a~~ an undisputed Certificate for Payment within the time stated in the Contract Documents, subject to justifiable withholding of payment as described herein or in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days for reasons within the Owner's control and through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other

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persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper ~~materials;~~materials to the point of negatively impacting the Project and/or the related schedule;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;~~or~~
- **.4** otherwise is guilty of substantial breach of a provision of the Contract ~~Documents.~~Documents; or
- **.5** the Contractor fails to prosecute the Work or any part thereof with promptness and diligence or goes into bankruptcy, liquidation, makes an assignment for the benefit of creditors, enters into a composition with its creditors, or becomes insolvent.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, ~~seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:~~three (3) business days' notice, terminate the Contractor's right to proceed with the Work, or such part of the Work as to which such defaults have occurred, and may take any one or more of the following actions:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

In the event the Contractor's surety bond requires notice of intent to declare a default of the Contractor and if such bond notice is provided by the Owner, such notice shall be adequate to satisfy the three (3) day written notice described above in this Section.

The three (3) day notice period identified in this Section does not give rise to an opportunity for the Contractor to cure the cause for termination. Further, the Owner's failure to properly follow the termination procedure shall not be a substantial or material breach of the Contract or the Owner's obligations.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner in pursuing termination and completion of the Work, including actual attorney and legal fees and costs, and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

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.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly ~~executed;~~ executed and costs incurred by reason of the ~~termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~termination.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the ~~Contract.~~ Contract, including, but not limited to, additional sums, additional time for performance, or damages for delay. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents. The Contractor shall not knowingly (as "knowingly" is defined in the Federal False Claims Act, 31 USC 3729, *et seq.*) present or cause to be presented a false or fraudulent Claim. As a condition precedent to making a Claim by the Contractor, the Claim shall be accompanied by an affidavit sworn to before a notary public or other person authorized to administer oaths in the State of Michigan and executed by an authorized representative of the Contractor, which states that, "The Claim which is submitted herewith complies with subparagraph 15.1.1 of the General Conditions, as amended, which provides that the Contractor shall not knowingly present or cause to be presented a false or fraudulent claim." Claims of the Owner shall be governed by the relevant Michigan statutory limitations period, excepting Warranty claims which shall be controlled by the warranty documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims as set forth herein and subject to law and shall pursue all causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2. The Owner shall commence all claims and causes of action in accordance with Section 13.1 and Section 15.1.2.1, regardless of any other time frames identified in the Contract Documents. The Contractor shall commence all Claims and causes of action in accordance with Section 15.1.2 and Section 15.1.3, other provisions of the Contract, and in accordance with Michigan law.

§ 15.1.2.1 Regardless of any provisions to the contrary, the limitations period with respect to any Claim or cause of action by the Owner with respect to defective or nonconforming Work shall not commence until the discovery of such defective or nonconforming Work by the Owner. See also Section 13.1.

§ 15.1.2.2 Surety Notice and Prior Approval

Except where otherwise expressly required by the terms of the Agreement or the General Conditions, exercise by the Owner of any contractual or legal right or remedy without prior notice to or approval by the Contractor's surety shall in no way prohibit the Owner's ability to pursue such right or remedy. Further, pursuit of such a right or remedy

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without prior notice to or approval of surety shall in no way compromise, limit or bar any claim by the Owner against a surety bond of the Contractor.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by ~~either~~ the ~~Owner or~~ Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the ~~other party~~ Owner and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by ~~either party under this Section 15.1.3.1~~ the Contractor shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the ~~claimant~~ Contractor first recognizes the condition giving rise to the Claim, whichever is later. The Contractor's failure to timely and properly initiate a Claim shall be an absolute and irrevocable waiver of such Claim and any cause of action. Claims and causes of action by the Owner shall be governed by the applicable statute of limitations period. The parties acknowledge, understand, and agree that the Contractor's required prompt filing of a Claim is critical to the Project, as Contractor Claims often affect the Project schedule and/or Project budget, and that the deadline and waiver applicable to Contractor Claims is a material inducement to the Owner entering into an agreement with the Contractor.

§ 15.1.3.2 ~~Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.~~**NOT USED.**

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a ~~Claim,~~ Claim or cause of action, including mediation, arbitration and/or litigation, as applicable, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make undisputed payments in accordance with the Contract Documents.

§ 15.1.4.2 ~~The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.~~**NOT USED.**

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Failure to provide such notice shall serve as an absolute bar against a Claim or cause of action for such an increase in the Contract Sum. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. A Project delay shall not be a basis for a Claim or cause of action for additional cost by the Contractor, except for costs related to payment of staff and extended general conditions.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of ~~the Work.~~ the Work due to the increase in Contract Time and allowable costs (e.g., payment of staff and general conditions) sought. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

~~The~~ As permitted by law, the Contractor and Owner waive Claims and/or causes of action against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 , without limitation damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

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This mutual waiver is applicable, without limitation, to all consequential damages due to either party's ~~termination in accordance with Article 14.~~ termination. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 ~~Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall~~ Claims of the Contractor shall, and Claims of the Owner may, be referred to the Initial Decision Maker for initial ~~decision.~~ interpretation. The Architect will serve as the Initial Decision ~~Maker, unless otherwise indicated in the Agreement.~~ Maker. Except for those Claims excluded by this Section 15.2.1, an initial ~~decision~~ interpretation shall be required as a condition precedent to ~~mediation of any Claim. If an initial decision~~ mediation, arbitration and/or litigation of any Claim brought by the Contractor against the Owner. If an initial interpretation has not been rendered within 30 days after ~~the~~ a Contractor-required or Owner-requested Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without ~~a decision~~ an interpretation having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to ~~resolve the Claim.~~ interpret the Claim. Within ten (10) days of a written request, the Contractor shall make available to the Owner or its representative all of its books, records, or other documents in its possession or to which it has access relating to a Claim and shall require its Subcontractors, regardless of tier, and suppliers to do the same.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering ~~a decision.~~ an interpretation. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker ~~will~~ will, based on its interpretation, either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial ~~decision~~ interpretation approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial ~~decision~~ interpretation shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any recommended change in the Contract Sum or Contract Time or both. ~~The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.~~ If the Claim is timely and properly asserted, the initial interpretation shall be subject to the parties' agreed-upon dispute resolution process.

§ 15.2.6 ~~Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.~~ **NOT USED.**

~~**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.~~

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§ 15.2.7 In the event of a Claim against the Contractor, the ~~Owner~~ Owner, Architect or Initial Decision Maker may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the ~~Owner~~ Owner, Architect or Initial Decision Maker may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

~~**§ 15.2.8** If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.~~

§ 15.3 Mediation

§ 15.3.1 Except as stated in this Agreement or otherwise agreed in writing by the parties, Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections ~~9.10.4, 9.10.5, and 15.1.7,~~ 9.10.4 and 9.10.5, shall be subject to mediation as a condition precedent to ~~binding dispute resolution.~~the parties' agreed-upon dispute resolution process.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the ~~filing of binding~~ commencement of the parties-agreed-upon dispute resolution proceedings but, in such event, mediation shall proceed in advance of ~~binding dispute resolution~~ such proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. ~~If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~ All limitations periods shall be tolled during the mediation process.

§ 15.3.3 ~~Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.~~**NOT USED.**

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

~~**§ 15.4 Arbitration**~~

~~**§ 15.4.1** If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~

~~**§ 15.4.1.1** A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

~~**§ 15.4.2** The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

~~**§ 15.4.3** The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

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§ 15.4.4 Consolidation or Joinder

The Contractor further agrees to include similar dispute resolution provisions in all agreements with the Subcontractors, suppliers, and independent contractors and consultants retained for the Project and to require them to include a similar dispute resolution provision in all agreements with Subcontractors, all subconsultants, suppliers or fabricators so retained, thereby providing for a consistent method of dispute resolution between the parties to those agreements. Subject to the other limitations periods identified in these General Conditions which are understood to govern over this sentence, no demand for mediation or arbitration shall be made after the date when the applicable statutes of limitation would bar legal or equitable proceedings. During the pendency of any mediation or arbitration, all applicable limitations periods shall be tolled until the conclusion of that process.

The Owner reserves the right in its discretion to require consolidation or joinder of any mediation or other legal proceeding arising out of or relating to this Agreement or any of the agreements incorporated by reference with another mediation or other legal proceeding involving (i) a person or entity not a party to this Agreement or (ii) an independent contractor or consultant engaged by the Owner in connection with the Project, in any event the Owner believes such consolidation or joinder is necessary in order to resolve a dispute or avoid duplication of time, expense or effort. In the event the Owner is involved in a dispute which is not subject to mediation or arbitration involving a person or entity not a party to this Agreement, the mediation and arbitration provisions of this article shall be deemed to be void and nonexistent in the event Owner, in its discretion, determines the Contractor should become a party to that dispute by joinder or otherwise. Any mediation or arbitration hearing shall be held in the general location where the Project is located, unless another location is mutually agreed upon.

Modified: 09/26/22; 11:22 am~~**§ 15.4.4.1** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).~~

~~**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.~~

~~**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~

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Certification of Document's Authenticity

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_____

(Signed)

_____

(Title)

_____

(Dated)

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THE CHRISTMAN COMPANY

SUPPLEMENTARY GENERAL CONDITIONS

AIA A201 -2007

Dated January 19, 2010; Revised 1/15/15

These Supplementary General Conditions modify the AIA A201 General Conditions, 2007 version, the Contract between the parties and all of the Contract Documents incorporated therein by reference as follows;

The terms and conditions of these Supplementary General Conditions shall control over all other Contract Documents in the event of any ambiguity or inconsistency.

Section 1.1.1 shall be amended as follows:

The first sentence is amended to read: "The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, The Christman Company Supplementary General Conditions AIA A201-2007 dated January 19, 2010 and revised 1/15/2015, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract.

Section 1.2.1 shall be amended as follows:

In the first line, strike "The intent of the Contract Documents is to", and substitute "The Contract Documents shall".

Section 3.3.1:

Strike "solely" from the last sentence.

Section 3.5 shall be modified as follows:

Delete "and Architect" in the first line. Revise "and will be free from defects" to "and will be free from defects caused by Contractor or any one of its subcontractors or suppliers." All Contractor's warranties provided for Owner-furnished equipment or equipment installed by Contractor as called for in the Contract Documents shall be limited to labor for the installation, and Owner's warranty rights are otherwise limited to the manufacturer's warranties. There are no warranties of merchantability or fitness for a particular purpose and the parties all agree that the Uniform Commercial Code has no application to this contract as this is a labor and services intensive contract.

Section 3.10.2:

Strike the last line in Section 3.10.2.

Section 3.12.11:

Insert "Under no circumstances shall this Section 3.12 or any other section of this Agreement be read or interpreted to create design obligations or responsibilities on behalf of Contractor."

Section 3.18.1 shall be amended as follows:

Delete "Architect, Architect's consultants, and agents" and change "employees of any of them" to "employees of the Owner."

Delete "regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder."

Section 9.10.2 shall be amended as follows:

This Section 9.10.2 shall not apply to liens recorded as a result of the Owner's failure to make timely payment as required under the Contract Documents.

Delete "and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner" stated in (2) in the first sentence.

Section 11.1.3 shall be amended as follows:

Delete the second sentence in Section 11.1.13.

Insert at the end of Section 11.1.3 "The Contractor shall provide written notification to the Owner of the cancellation or expiration of any insurance required by Section 11.1. The Contractor shall provide such written notice within five (5) business days of the date the Contractor is first aware of the cancellation or expiration, or is first aware that the cancellation or expiration is threatened or otherwise may occur, whichever comes first."

Section 11.3.6 shall be amended as follows:

Delete the third sentence in Section 11.3.6.

Replace with "The Owner shall provide written notification to the Contractor of the cancellation or expiration of any insurance required by Section 11.3. The Owner shall provide such written notice within five (5) business days of the date the Owner is first aware of the cancellation or expiration, or is first aware that the cancellation or expiration is threatened or otherwise may occur, whichever comes first."

Section 15.2.5:

Strike the last sentence in Section 15.2.5.

Section 15.4 Arbitration:

Strike Section 15.4 Arbitration.

END OF SECTION

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Job #: 221125-090 LSD Willow School

Lansing, Michigan 48933

The Christman Company

CD Set Revised

Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
General					
G0.1	TITLE SHEET	4	01/26/2024	02/19/2024	CD Set Revised
G0.2	DATA SHEET	3			CD Set Revised
Civil					
C0.0	COVER	3			CD Set Revised
C1.0	GENERAL PLAN	4			CD Set Revised
C2.1	DEMOLITION PLAN	4			CD Set Revised
C3.1	SESC PLAN	4			CD Set Revised
C3.2	SESC DETAILS	4			CD Set Revised
C4.1	PAVING PLAN	4			CD Set Revised
C4.2	PAVING DETAILS	3			CD Set Revised
C5.1	GRADING PLAN	3			CD Set Revised
C5.2	GRADING PLAN	1			CD Set Revised
C6.1	UTILITY PLAN	3			CD Set Revised
C6.2	UTILITY DETAIL	1			CD Set Revised
C6.3	UTILITY DETAIL	1			CD Set Revised
C6.4	UTILITY DETAIL	1			CD Set Revised
C7.1	DRAINAGE AREA MAP	3			CD Set Revised
S22128A	SURVEY	2			CD Set Revised
Landscape					
L1.00	PLAYGROUND OVERALL SITE PLAN	1			CD Set Revised
L1.01	PLAYGROUND SITE PLAN	2			CD Set Revised
L1.02	PLAYGROUND DIMENSION PLAN	2			CD Set Revised
L1.03	PLAYGROUND DRAINAGE PLAN	2			CD Set Revised
LA1.1	LANDSCAPE PLAN	0			CD Set Revised
LD1.01	PLAYGROUND DETAILS	2			CD Set Revised
Structural					
S0.01	STRUCTURAL NOTES	3			CD Set Revised
S0.02	SPECIAL INSPECTIONS & LOADINGS	3			CD Set Revised
S0.03	TYPICAL DETAILS	3			CD Set Revised
S0.04	TYPICAL DETAILS	3			CD Set Revised
S1.01	FOUNDATION PLAN UNIT 100	3			CD Set Revised
S1.02	FOUNDATION PLAN UNITS 200, 300, 400	3			CD Set Revised
S1.11	LOW ROOF FRAMING PLAN UNIT 100	3			CD Set Revised

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Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
S1.21	HIGH ROOF FRAMING PLAN UNIT 100	3			CD Set Revised
S1.22	ROOF FRAMING PLAN UNITS 200, 300, 400	3			CD Set Revised
S1.30	ENLARGED STEEL FRAMING PLANS AND DETAILS	3			CD Set Revised
S2.01	SECTIONS & ISOMETRIC UNIT 100	3			CD Set Revised
S2.02	DETAILS	4			CD Set Revised
S3.01	EXTERIOR ELEVATIONS UNIT 100	1			CD Set Revised
S3.02	EXTERIOR ELEVATIONS UNITS 200, 300, 400	3			CD Set Revised
S4.01	DETAILS	3			CD Set Revised
S4.02	DETAILS	2			CD Set Revised
Architectural					
A0.1	COMPOSITE FLOOR PLAN	3			CD Set Revised
A0.2	COMPOSITE CLERESTORY FLOOR PLAN	3			CD Set Revised
A0.3	ROOF COMPOSITE PLAN	3			CD Set Revised
A0.4	CODE COMPLIANCE PLAN	2			CD Set Revised
A1.1A	FLOOR PLAN - UNIT 100A	3			CD Set Revised
A1.1B	FLOOR PLAN - UNIT 100B	3			CD Set Revised
A1.2	FLOOR PLAN - UNIT 200	3			CD Set Revised
A1.3	FLOOR PLAN - UNIT 300	3			CD Set Revised
A1.4	FLOOR PLAN - UNIT 400	3			CD Set Revised
A1.5	EQUIPMENT PLAN - UNIT 100	1			CD Set Revised
A1.6	EQUIPMENT PLAN - UNIT 200	1			CD Set Revised
A1.7	EQUIPMENT PLAN - UNIT 300	1			CD Set Revised
A1.8	EQUIPMENT PLAN - UNIT 400	1			CD Set Revised
A1.9	EQUIPMENT SCHEDULES & DETAILS	1			CD Set Revised
A1.10	SIGNAGE	1			CD Set Revised
A1.11	ENLARGED PLANS	1			CD Set Revised
A2.1A	REFLECTED CEILING PLAN - UNIT 100A	3			CD Set Revised
A2.2	REFLECTED CEILING PLAN - UNIT 200	3			CD Set Revised
A2.3	REFLECTED CEILING PLAN - UNIT 300	3			CD Set Revised
A2.4	REFLECTED CEILING PLAN - UNIT 400	3			CD Set Revised
A2.5	INTERIOR PARTITION TYPES	3			CD Set Revised
A3.1A	EXTERIOR ELEVATIONS - UNIT 100A	1			CD Set Revised
A3.1B	EXTERIOR ELEVATIONS - UNIT 100B	1			CD Set Revised
A3.2	EXTERIOR ELEVATIONS - UNIT 200	3			CD Set Revised
A3.3	EXTERIOR ELEVATIONS - UNIT 300	3			CD Set Revised
A3.4	EXTERIOR ELEVATIONS - UNIT 400	3			CD Set Revised
A3.5	BUILDING SECTIONS - UNIT 100	3			CD Set Revised
A3.6	BUILDING SECTIONS - UNIT 200	3			CD Set Revised

The Christman Company

Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
A3.7	BUILDING SECTIONS - UNIT 300	3			CD Set Revised
A3.8	BUILDING SECTIONS - UNIT 400	3			CD Set Revised
A4.1	WALL SECTIONS	3			CD Set Revised
A4.2	WALL SECTIONS	3			CD Set Revised
A4.3	WALL SECTIONS	2			CD Set Revised
A4.4	JOB NO. 2616.01A	0			CD Set Revised
A5.1	BUILDING DETAILS	3			CD Set Revised
A5.2	BUILDING DETAILS	2			CD Set Revised
A5.3	BUILDING DETAILS	2			CD Set Revised
A5.4	BUILDING DETAILS	2			CD Set Revised
A6.1	DOOR SCHEDULE	3			CD Set Revised
A6.2	OPENING ELEVATIONS	3			CD Set Revised
A6.3	DOOR & WINDOW DETAILS	3			CD Set Revised
A6.4	DOOR & WINDOW DETAILS	3			CD Set Revised
A8.1	COLOR LAYOUT PLAN - UNIT 100	3			CD Set Revised
A8.2	COLOR LAYOUT PLAN - UNIT 200	3			CD Set Revised
A8.3	COLOR LAYOUT PLAN - UNIT 300	3			CD Set Revised
A8.4	COLOR LAYOUT PLAN - UNIT 400	3			CD Set Revised
A9.1	INTERIOR ELEVATIONS	3			CD Set Revised
A9.2	INTERIOR ELEVATIONS	3			CD Set Revised
A9.3	INTERIOR ELEVATIONS	3			CD Set Revised
A9.4	INTERIOR ELEVATIONS	2			CD Set Revised
A9.5	INTERIOR ELEVATIONS	2			CD Set Revised
A9.6	INTERIOR ELEVATIONS-UNIT 200	2			CD Set Revised
A9.7	INTERIOR ELEVATIONS-UNIT 300	2			CD Set Revised
A9.8	INTERIOR ELEVATIONS-UNIT 400	2			CD Set Revised
Food Service					
FS1.0	OVERALL FOODSERVICE EQUIPMENT PLAN	2			CD Set Revised
FS1.1	FOODSERVICE EQUIPMENT PLAN	3			CD Set Revised
FS2.1	FOODSERVICE PLUMBING / MECHANICAL PLAN	2			CD Set Revised
FS3.1	FOODSERVICE EQUIPMENT ELECTRICAL PLAN	2			CD Set Revised
FS4.1	SPECIAL CONDITIONS AND DETAIL CALL-OUT PLAN	2			CD Set Revised
FS4.2	FOODSERVICE EQUIPMENT DETAILS	2			CD Set Revised
FS4.3	FOODSERVICE EQUIPMENT DETAILS	2			CD Set Revised
FS5.1	FOODSERVICE WALK-IN DETAILS	2			CD Set Revised
FS5.2	FOODSERVICE WALK-IN DETAILS	2			CD Set Revised
FS6.1	FOODSERVICE VENTILATION DETAILS	2			CD Set Revised
FS6.2	FOODSERVICE VENTILATION DETAILS	2			CD Set Revised

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Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
FS6.3	FOODSERVICE VENTILATION DETAILS	2			CD Set Revised
FS6.4	FOODSERVICE VENTILATION DETAILS	2			CD Set Revised
FS6.5	FOODSERVICE VENTILATION DETAILS	2			CD Set Revised
Plumbing					
P1.1A	PLUMBING PLAN - UNIT 100A	3			CD Set Revised
P1.1UGA	UNDERGROUND PLUMBING PLAN - UNIT 100A	1			CD Set Revised
P1.2	PLUMBING PLAN - UNIT 200	1			CD Set Revised
P1.2UG	UNDERGROUND PLUMBING PLAN - UNIT 200	1			CD Set Revised
P1.3	PLUMBING PLAN - UNIT 300	1			CD Set Revised
P1.3UG	UNDERGROUND PLUMBING PLAN - UNIT 300	1			CD Set Revised
P1.4	PLUMBING PLAN - UNIT 400	1			CD Set Revised
P1.4UG	UNDERGROUND PLUMBING PLAN - UNIT 400	1			CD Set Revised
P4.0	ENLARGED KITCHEN PLUMBING PLANS	3			CD Set Revised
P4.1	ENLARGED PLUMBING PLANS	2			CD Set Revised
P5.0	PLUMBING DETAILS	3			CD Set Revised
P6.0	PLUMBING SCHEDULES	3			CD Set Revised
Mechanical					
M0.0	MECHANICAL GENERAL INFORMATION	3			CD Set Revised
M1.11A	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 100A	1			CD Set Revised
M1.12	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 200	1			CD Set Revised
M1.13	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 300	1			CD Set Revised
M1.14	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 400	1			CD Set Revised
M5.0	MECHANICAL DETAILS	3			CD Set Revised
M6.0	MECHANICAL SCHEDULES	3			CD Set Revised
M6.1	MECHANICAL SCHEDULES	3			CD Set Revised
M6.2	MECHANICAL SCHEDULES	1			CD Set Revised
M7.0	MECHANICAL RISER DIAGRAMS	3			CD Set Revised
M8.0	CONTROL DIAGRAMS	3			CD Set Revised
M8.1	CONTROL DIAGRAMS	3			CD Set Revised
M8.2	CONTROL DIAGRAMS	3			CD Set Revised
M8.3	CONTROL DIAGRAMS	3			CD Set Revised
M8.4	CONTROL DIAGRAMS	3			CD Set Revised
MH1.1A	MECHANICAL HVAC PLAN - UNIT 100A	3			CD Set Revised
MH1.2	MECHANICAL HVAC PLAN - UNIT 200	1			CD Set Revised
MH1.3	MECHANICAL HVAC PLAN - UNIT 300	1			CD Set Revised
MH1.4	MECHANICAL HVAC PLAN - UNIT 400	1			CD Set Revised
MP1.1A	MECHANICAL PIPING PLAN - UNIT 100A	3			CD Set Revised
MP1.2	MECHANICAL PIPING PLAN - UNIT 200	1			CD Set Revised

The Christman Company

Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
MP1.3	MECHANICAL PIPING PLAN - UNIT 300	1			CD Set Revised
MP1.4	MECHANICAL PIPING PLAN - UNIT 400	1			CD Set Revised
Fire Protection					
FP1.1A	FIRE PROTECTION PLAN - UNIT 100A	3			CD Set Revised
FP1.2	FIRE PROTECTION PLAN - UNIT 200	1			CD Set Revised
FP1.3	FIRE PROTECTION PLAN - UNIT 300	1			CD Set Revised
FP1.4	FIRE PROTECTION PLAN - UNIT 400	1			CD Set Revised
Electrical					
E0.0	ELECTRICAL GENERAL INFORMATION	2			CD Set Revised
E0.1	LIGHTING SCHEDULES	2			CD Set Revised
E4.0	ENLARGED ELECTRICAL PLANS	2			CD Set Revised
E5.0	ELECTRICAL DETAILS	2			CD Set Revised
E5.1	ELECTRICAL DETAILS	2			CD Set Revised
E6.0	PANEL SCHEDULES - 480/277V PANELS	2			CD Set Revised
E6.1	PANEL SCHEDULES - 208/120V PANELS	2			CD Set Revised
E6.2	PANEL SCHEDULES - 208/120V PANELS	2			CD Set Revised
E7.0	ELECTRICAL ONE-LINE/RISER DIAGRAM	2			CD Set Revised
E7.1	PHOTOVOLTAIC RISER DIAGRAM	2			CD Set Revised
EL1.1A	LIGHTING PLAN - UNIT 100A	2			CD Set Revised
EL1.1B	LIGHTING PLAN - UNIT 100B	2			CD Set Revised
EL1.2	LIGHTING PLAN - UNIT 200	1			CD Set Revised
EL1.3	LIGHTING PLAN - UNIT 300	1			CD Set Revised
EL1.4	LIGHTING PLAN - UNIT 400	1			CD Set Revised
EP1.1A	POWER PLAN - UNIT 100	2			CD Set Revised
EP1.1B	POWER PLAN - UNIT 100B	2			CD Set Revised
EP1.2	POWER PLAN - UNIT 200	1			CD Set Revised
EP1.3	POWER PLAN - UNIT 300	1			CD Set Revised
EP1.4	POWER PLAN - UNIT 400	1			CD Set Revised
EP2.1A	POWER MECHANICAL EQUIPMENT PLAN - UNIT 100A	1			CD Set Revised
EP2.2	POWER MECHANICAL EQUIPMENT PLAN - UNIT 200	1			CD Set Revised
EP2.3	POWER MECHANICAL EQUIPMENT PLAN - UNIT 300	1			CD Set Revised
EP2.4	POWER MECHANICAL EQUIPMENT PLAN - UNIT 400	1			CD Set Revised
EP3.1A	ROOF POWER PLAN - UNIT 100A	1			CD Set Revised
EP3.2	ROOF POWER PLAN - UNIT 200	1			CD Set Revised
EP3.3	ROOF POWER PLAN - UNIT 300	1			CD Set Revised
EP3.4	ROOF POWER PLAN - UNIT 400	1			CD Set Revised
ES1.0	ELECTRICAL SITE POWER PLAN	2			CD Set Revised
ES1.1	ELECTRICAL SITE LIGHTING PLAN	2			CD Set Revised

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Job #: 221125-090 LSD Willow School

Lansing, Michigan 48933

The Christman Company

Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set
Telecommunications					
T0	Technology Systems	3			CD Set Revised
T1	Site Plan	3			CD Set Revised
T2	1st Floor Composite Fiber Infrastructure	2			CD Set Revised
T3.1A	Unit 100 Structured Cabling	3			CD Set Revised
T3.1B	Unit 200 Structured Cabling	3			CD Set Revised
T3.1C	Unit 300 Structured Cabling	3			CD Set Revised
T3.1D	Unit 400 Structured Cabling	3			CD Set Revised
T4.1A	Unit 100 Clock System Public Address System	3			CD Set Revised
T4.1B	Unit 200 Clock System Public Address System	3			CD Set Revised
T4.1C	Unit 300 Clock System Public Address System	3			CD Set Revised
T4.1D	Unit 400 Clock System Public Address System	3			CD Set Revised
T5.1A	Unit 100 Audiovisual Systems	3			CD Set Revised
T5.1B	Unit 200 Audiovisual Systems	3			CD Set Revised
T5.1C	Unit 300 Audiovisual Systems	3			CD Set Revised
T5.1D	Unit 400 Audiovisual Systems	3			CD Set Revised
T6.1A	Unit 100 Access Control System	3			CD Set Revised
T6.1B	Unit 200 Access Control System	3			CD Set Revised
T6.1C	Unit 300 Access Control System	3			CD Set Revised
T6.1D	Unit 400 Access Control System	3			CD Set Revised
T7	Site Plan Video Surveillance System	4			CD Set Revised
T7.1A	Unit 100 Video Surveillance System	3			CD Set Revised
T7.1B	Unit 200 Video Surveillance System	3			CD Set Revised
T7.1C	Unit 300 Video Surveillance System	3			CD Set Revised
T7.1D	Unit 400 Video Surveillance System	3			CD Set Revised
T9.1	Details	2			CD Set Revised
T9.2	Details	2			CD Set Revised
T9.3	Details	2			CD Set Revised
Geothermal					
GHX1.0	GEOTHERMAL SITE PLAN	3			CD Set Revised
GHX5.0	GEOTHERMAL DETAILS	3			CD Set Revised

Section 00210 - Special Provisions

1. General - All Bidders are responsible to review all work categories descriptions, and report any conflicts or ambiguities which may affect the execution of their Work Categories. All Bidders are responsible to review all Bidding Documents and become familiar with them to coordinate their work accordingly. Work Category descriptions should in no way be construed as being all-inclusive. Should a conflict exist between the Work Category description and other Bidding Documents, the Work Category description shall prevail and take precedence. Bidders are required to bid the entire Work Category and may bid more than one Work Category.

2. Electronic Documentation – In an effort to promote sustainability, information shall be conveyed electronically to the greatest extent possible.

3. Labor Requirements – This project has no labor rate requirements.

4. Construction Waste Management And Disposal – Review Spec Section 017419 Construction Waste Management And Disposal.

5. General Commissioning Requirements – Review Spec Section 019113 General Commissioning Requirements.

6. Indoor Air Quality Management Plan – During Construction. Comply with site specific IAQ Management Plan for this project.

7. Parking – Limited parking is available on-site. Additional parking is available on side streets.

8. Project Scheduling - A preliminary project schedule has been included within the Bidding Documents for your review and use. As input from the Trade Contractors is provided and as progress begins, this schedule will be periodically updated and re-issued. Each Trade Contractor is required to become familiar with the preliminary schedule and sequence their work accordingly. Activity durations shall be maintained regardless of actual start dates.

9. Post Bid interviews – We will be holding post bid interviews for the low qualified bidders immediately after bids are received. It is essential to the interview process that the primary and secondary Trade Contractors are included in the meeting, as well as the intended project foreman and project manager. The purpose of the interview will be to discuss the bids but will also focus on schedule, submittals, safety, site utilization and unique project requirements. These are to be conducted week of February 26th

10. Shop Drawings & Submittals –The Trade Contractor shall review, approve in writing, and submit through the Construction Manager all submittals within two weeks after contract award at the latest, as to cause no delay in the work or in the work of any separate Trade Contractor. Shop drawings, product data and samples shall be properly identified as specified or as the Construction Manager may require. At the time of submission, each Trade Contractor shall inform the Construction Manager in writing of any deviation in the shop drawings, product data or samples from the requirements of the Bidding Documents.

    For Re-Submittals – Each Trade Contractor shall make any corrections required by the Construction Manager or Architect and shall resubmit the shop drawings, product data or new samples until approved. Each Trade Contractor shall direct specific attention, in writing or on resubmitted shop drawings, product data or samples, to revisions other than those requested by the Construction Manager or Architect on previous submittals. Refer to Section 01300 Submittals for definitions of Action Markings.)

11. Procore –The Christman Company has set up a Procore project for the construction documents for the This website will be used for (not limited to) the following:

a. Submittal upload and approvals

b. RFI upload and approvals

c. Updated drawings

d. Updated schedule

e. Meeting minutes

f. Project directory

g. Testing reports

h. Notice of commencement

i. Safety Information

j. Quality Control Logs

k. Punch Lists

12. Submittal Uploads –All submittals must be submitted to The Christman Company via Procore and must be the original PDF document. Hard copies or re-scanned documents will not be accepted. The only exception is actual samples (paint draw downs, masonry, etc.); however, all brochures and product data related to these samples must be submitted electronically. For any questions regarding this process, email austin,brown@christmanco.com.

13. Schedule of Values (SOV) – Per Section 01370 Schedule of Values, submit for approval through the Trade Contractor Portal. Once approved, adhere to the Application for Payment process. The SOV must be divided up by: building, type of work, general conditions, supervision, insurance, submittals, closeout, labor and materials. No single item can be greater than $100,000.

14. Application for payment – Create and Submit the Pay Application through the Trade Contractor Portal. Payment period: Signed payment applications are due the 25th of each month. Each request for payment shall be provided with a fully executed sworn statement along with its relative unconditional waivers. All subcontractors and suppliers are to be listed on the sworn statement.

15. Change Management – Refer to Sections 01150 and 01019 for definitions, but the following change management documents will be utilized on this project: Bulletins

16. Existing Services – There are no existing utilities to be assumed for this project, all demolition activities will remove any existing storm, water, sewer, gas, electricity and internet connections. Trades will be responsible to furnish and supply their own required connections. Temporary power for the use during construction is the responsibility of the electrical contractor for use by other trades, and must accommodate standard 120V equipment as necessary. Any special requirements for electrical feeds must be supplied by that trade. Temporary water is to be the responsibility of the mechanical contractor to feed a single hydrant line to the project site, with special provisions to accommodate city regulations, and protect against frost/freezing in the winter months.

17. Temporary Power – Please note that there will ne not temporary power/lighting provided on site. All site contractors will be responsible for providing their own power and lighting withing MIOSHA standards. WC 28 will set up power and lighting within the building immediately after concrete has been installed. Temp power will include 20 AMP 120V. Any additional power needed is the responsibility of the contractor needing the power.

18. Hoisting – In general, any hoisting activities required to be used on-site must be reviewed in advance with Construction Manager for coordination of site logistics, safety procedures, access, lift swing areas, duration, and overall activities relating to the hoisting equipment.

19. Site Boundaries – Boundaries of this site are established in the site plans and surveys conducted by required parties,

20. Existing Facilities – There are no existing facilities on this project. Portable chemical toilets will be provided and are to be utilized for the duration of the project.

21. Material Deliveries and Staging – Due to the limited lay-down area available, all material deliveries must be coordinated with the Construction Manager a minimum of 24-hours in advance of said delivery. At no time, will delivery trucks be allowed to stage or park on existing roads and parking lots. Queuing for trucks will be available on-site at designated locations as coordinated with the Construction Manager. If deliveries require traffic control, the Trade Contractor is required to provide flagmen accordingly. All Trade Contractors are responsible for directing responsible trucks into project site, unloading of materials, handling, protection and storage of all received equipment. The Owner and Construction Manager will not accept deliveries.

22. Communication and Phones – All Trade Contractor field supervision shall have cellular phones available for communication with The Christman Company's field personnel. All project managers shall have email access for communications with The Christman Company's office personnel. Cell phone use by trade personnel (non-supervisory) will not be permitted, except during breaks or lunch.

23. Independent Testing, Inspections and Commissioning – The Owner has arranged independent testing for certain portions of the project. All Trade Contractors are to cooperate and provide access and assistance for the independent testing and inspections to be performed. These services include at a minimum: soil/material testing and commissioning.

24. Layout – The Construction Manager will provide two perpendicular control lines and one benchmark indicated on the documents .

25. Noise, Odors & Vibration – Due to close proximity of residential homes, vibration must be closely monitored as to not cause any damage to the existing building and facilities. Odor causing chemicals, adhesives, paints, cleaning supplies must have MSDS sheets submitted and approved by the Construction Manager prior to use. All equipment shall be self powered and all diesel powered equipment shall be operated with "Bio-diesel" fuels and/or emission "scrubbers" to reduce exhaust fumes.

26. Jobsite Safety Orientation – All Trade Contractors of any tier and visitors entering this jobsite will be required to check-in with the Construction Manager upon arrival at the project site. Check-in procedures will include the review and acknowledgement of the Construction Managers Project Specific Safety Orientation and Policies. All construction personnel will be required to wear The Christman Company issued safety sticker when working on or visiting this jobsite).

    a. Safety (see contract form section for project safety program) - It is a fundamental value of the Construction Manager that safety is always a primary consideration. There is no phase of the project that has greater importance than accident prevention and the preservation of human resources. The Construction Manager's safety program is stringent and rigorous. The following represents a few important pre-construction requirements that apply to this project. Before any awarded Trade Contractor starts work on-site, the following requirements shall be satisfied:

        i. Provide a copy of Trade Contractor's site specific safety program.

ii. Attend Construction Manager's project specific safety orientation program, which includes review of our safety video, review of project specific written safety program, review of Project Specific Infection Control Policy, sign-in and badging requirements.

iii. No tobacco products, including but not limited to cigarettes, cigars, chewing tobacco, etc. are permitted on Lansing School District premises.

iv. Provide a copy of Safety Data Sheets (SDS) for all proposed materials.

v. Hardhats, High Vis, and safety glasses are to be worn at all times. Additional personal protection equipment will be worn appropriately based on the work performed.

vi. Designate a Safety Representative(s) who will be working on-site – Provide telephone numbers and emergency telephone numbers.

vii. Hoisting over occupied areas will not be permitted unless areas are vacated or a controlled access program initiated.

viii. Hot work permits shall be obtained as required, including fire watch requirements.

ix. Shut down notifications shall be obtained as required with a minimum of five (5) working days advance notice.

x. An understanding of our safety program and specifically our policy that in the event of an injury or near miss, all parties involved will be required to take a drug screening test immediately. Failure to perform the required test will result in removal from the site.

xi. Fall protection shall be worn and used, 100% of the time, by all persons when there is exposure to a fall greater than six (6) feet unless other provisions such as guardrails, safety nets, or fall restraints have been provided. This includes, but is not limited to, steel erection (including connecting, bolting-up, decking, welding or any other steel erection activity), pre-cast erection, roofing activities and masonry work including overhand laying operations.

xii. Hot Work Permits - Hot work permits will be required during all cutting, grinding, welding and torch cutting activities, including fire watch requirements. These permits are to be filled out in the jobsite trailer with a copy of it to be placed at the place of hot work.

27. Unsupported Walls – This project will include unsupported walls exposed to wind during construction. All contractors working within the restricted zones will be required to have proper training per the MIOSHA Part 2 Masonry Wall Bracing requirements.

28. Progress Cleanup – A composite clean-up crew will be assembled each Wednesday immediately after lunch. Each Trade Contractor shall provide labor and supplies as directed by the Construction Manager to support this effort. This does not relieve any Trade Contractor of their responsibility to cleanup all debris resulting from their own operations on a continuous basis and discard waste into jobsite dumpsters provided by the Construction Manager (as identified in section 01524), Each Trade Contractor shall clean all surfaces and leave the work area "broom clean" or its equivalent, unless otherwise specified.

If contractors do not maintain their work areas or provide the proper resources for our daily clean up, The Christman Company will provide one warning to the contractor. If the problem continues after the warning, The Christman Company will provide labor for the relative clean-up at the cost of the contractor.

29. Drug Testing – Upon incident requiring drug testing (including but not limited to accident, damages, injury) the Construction Manager may require the responsible parties, or parties involved to submit a drug test within 24 hours of the incident.

30. As-Builts – As-Builts must be accurately updated throughout the project. At the end of the project, the trade contractor must update the As-Builts and forward the following to The Christman Company: CAD drawing file, PDF file and two full size hard copies.

31. Warranties – The contractor shall guarantee all materials and work for a period of two (2) years from Substantial Completion. Before final payment, Contactor must provide a letter of guarantee confirming the effective date and duration of the guarantee.

32. Waste Management/Indoor Air Quality Plan – The Construction Manager's Waste Management Plan and Indoor Air Quality plan will be strictly adhered to for this project. The trade contractors are responsible to provide the necessary resources to follow these guidelines.

33. RFI's – RFI's must be submitted to Projects@lansingschools,net prior to the specified RFI cutoff date to be considered for the Architect's review. RFI's received after the cutoff date will not receive an answer from the Architect, if any answer is provided. All Pre-bid RFI's will be published through an Addendum. During construction, all RFI's must be handled through Procore. Prebid RFI's are due June 18th, 2024.

34. Work Hours - Common jobsite working hours shall be 7:00 am to 3:30 pm, Monday through Friday. Any overtime, or working hours needed outside of the window described above, requires advance approval by Construction Manager. The Construction Manager reserves the right to alter the working schedule to 4/10s.

35. Hazardous Materials – There are no assumed hazardous materials on this project.

36. Sealant Schedule - Sealants are to be installed as listed in the schedule below. WC 19 has providing and installing all sealants on the project unless called out otherwise. If sealants are required within a product assembly, the work category installing that assembly is responsible for that sealant.

Sealant Schedule		
Item to be sealed	Responsible WC	Comments
Curb, Sidewalk, Concrete Paving	WC 05	
Asphalt Paving	WC 06	
Concrete Paving Joints	WC 19	
Masonry Systems	WC 19	
Roofing Systems	WC 14	
Metal Panel Systems	WC 15	For sealants within assemblies
Glazing Systems	WC 18	For sealants within assemblies
Face of Glazing Systems and Panel Systems	WC 19	
Door Frames	WC 19	
Plumbing fixtures	WC 19	

CHRISTMAN
SINCE 1894

PROJECT SAFETY MANUAL

Lansing School District
Willow – New Build
Lansing, MI

Statement of Safety Program

It is a fundamental value of The Christman Company that safety always is a primary consideration. It is our policy and a top priority to do all in our power to provide a safe work place for all workers and to mandate the use of good safety practices. Adherence to established safety standards and procedures is required of everyone at all times on the Willow Project site.

There is no phase of the operation that has greater importance than accident prevention and the preservation of human resources.

This Project Specific Safety Program has been developed in support of these concepts to serve as a reference in assisting all project trade contractors in satisfying their responsibility "to provide a safe, healthful work place, free of recognized hazards."

The Christman Company
Project Superintendent

The Christman Company
Andrew Dobbs
Project Manager

The Christman Company
Rob Crowe
Vice President

The Christman Company
Donald V. Staley
Vice President/Safety Director

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I. Introduction

This Project Safety Manual provides an administrative structure within which The Christman Company and subcontractors present on the Project site shall provide for the safety and health of their employees and other individuals affected by their activities and for the protection of property. This Manual does not relieve subcontractors of any of their traditional or specific legal responsibilities with respect to occupational safety and health or the protection of property. Instead, this Manual provides for coordination among the various subcontractors' individual programs, monitoring of subcontractors' conformance with their individual programs, and the requirements of this Manual, initiation of corrective actions when nonconformances are identified, and documentation of safety related programs, meetings, and incidents. This Project Safety Manual for Willow has been developed to assist all subcontractors working at the Project site in satisfying their responsibility to provide a safe and healthful work place, free of recognized hazards, for their employees.

All employees, subcontractors, trades people, and visitors are required to watch The Christman Company Safety Orientation Video prior to performing work at the site. The video may be viewed at the site office.

II. Implementation Responsibility

Each and every person working at the Project site shall be responsible to be knowledgeable of the contents of this Manual and comply with every requirement contained herein.

III. Subcontractor Safety Programs

Each subcontractor is required to submit a copy of its written safety program to The Christman Company prior to commencing work at the Project site. Each program shall meet the requirements of the codes and regulations of OSHA, local and other authorities having jurisdiction over the work to be performed and shall include disciplinary procedures and safety orientation training procedures applicable to subcontractor personnel.

Each subcontractor safety program shall include, as a minimum, the following requirements:

A. All trades are to complete a Jobsite Hazards Analysis (JHA) form every day for all work activities.

B. Conduct weekly safety (Tool Box) meetings.

C. Monitor jobsite safety issues daily.

D. Conduct fire inspections.

E. Review project specific requirements with employees.

F. Conduct tool and equipment inspections.

G. Review all personal protective equipment with employees.

H. Address fall protection measures.

I. Address Right-To-Know regulations, including Safety Data Sheets (SDS')

J. Provide hazardous material awareness training.

IV. Discipline Policy

All Subcontractors entering onto this Project are required to comply with all aspects of the project safety program requirements. Those that do not adhere to this program will be subject to this discipline policy. The Project will utilize a three step process for minor infractions; repeat or major offenses of the safety program are subject to immediate removal from the Project.

1. Any re-entry employment programs for safety violations will be initiated only by The Christman Company Superintendent and Project Manager.

2. Verbal warning - The verbal warning **shall be considered given** at the signing of the contract. This warning is to be communicated by the Subcontractor to **all** Subcontractor personnel prior to entering this Project.

3. Written warning - The second warning will be a written warning, documented, with a copy sent to the employee's Supervisor and Corporate Office.

4. A written warning, at the discretion of The Christman Company Superintendent, can result in either removal from the Project or re-orientation of the safety program. The re-orientation will be attended by both the violator and his/her Foreman. This re-orientation may consist of:
   - Video training in the related area of the violation
   - Written verification by the employee that he/she is capable of identifying the hazards related to the violation.
   - The completion of a written Job Hazard Analysis by the employee and his Foreman for the task in which the violation occurred.

5. In addition, any Foreman that has had his/her crew members attend three (3) re-orientation sessions for any reason is subject to removal from the Project.

6. The third infraction of the same safety program issue will result in removal from the Project.

7. Any Foreman, General Foreman, or Superintendent who forces or directs any employee to violate a safety procedure, will be removed from the Project immediately.

8. Any violation deemed threatening to life, limb or major property damage will be grounds for immediate removal from the Project.

Subcontractors will comply with all provisions of The Christman Company's safety program. In the event of Subcontractor's noncompliance, the Subcontract may be canceled, terminated, or suspended, in whole or in part, and The Christman Company may complete the work at the cost of the Subcontractor in accordance with the Subcontract Agreement.

V. Weekly Safety Meetings

The Christman Company will hold weekly construction coordination/safety meetings. All active, on-site subcontractors shall be represented at these meetings. At the beginning of each meeting current safety topics, issues, concerns and problems will be discussed.

Each active, on-site subcontractor shall conduct weekly toolbox meetings. Every worker active on site shall attend. Each subcontractor shall furnish the following documentation to The Christman Company after each toolbox meeting: date, topic(s) discussed, names of attendees, subcontractor's name, and any safety concerns noted.

VI. Safety Inspections

The Christman Company's Project Superintendent will conduct informal inspections of conditions, practices and equipment on a daily basis. The Christman Company's Safety Manager shall schedule visits to the Project site, unannounced, to inspect the work in progress. All safety discrepancies noted shall be reviewed with the Project Superintendent responsible to ensure that corrective measures are implemented.

Supervisors of all active on-site subcontractors are responsible to conduct daily inspections of conditions, practices, and equipment relating to their work areas/activities. Safety discrepancies discovered, along with the corrective measures taken, shall be reviewed with The Christman Company Project Superintendent.

VII. Drug/ Substance Abuse Testing Program

A. **Any employee injured at the Project site and needing offsite medical attention will be tested for alcohol and drugs.** If the injured party was hurt by the action of another person who was not injured, this person must also submit to substance abuse testing. Additionally, any employee causing or contributing to a major incident not resulting in injury will be tested for alcohol and drugs. An employee who tests positive for illegal substances or alcohol will not be allowed to return to the project site. Any employee who refuses to submit to substance abuse testing will not be allowed to work at the project site.

B. It is the responsibility of the employer to make sure that the testing is performed at the time of the incident. It is also the responsibility of the employer to cover any costs incurred due to the testing. Results of the testing will be considered confidential. **An employee that is tested late (not within 8 hours of the incident) will be considered as "not tested" and will not be allowed to return to work on the project site.**

Notes:

1. Visitors and delivery personnel are not included.

2. The drug-screening test shall include testing for cannabinoids, depressants, dissociative anesthetics, hallucinogens, opioids and morphine derivatives, and stimulants. **Refer to Attachment I.**

VIII. Hazardous Material Control Program

Each subcontractor is responsible for the safe storage, use and disposal of any hazardous material required to perform their scope of work. Each subcontractor using such materials shall provide The Christman Company with a copy of their Hazardous Material Control Program before any of his material is delivered to the Project site. Each program shall, at a minimum, include the following:

A. Identification and classification of hazardous materials
B. Safety and health precautions
C. Training in safe storage, handling and use
D. Transporting, labeling, packaging, documenting and disposal requirements
E. Safety Data Sheets (SDS) for all chemicals

Each subcontractor is to submit to The Christman Company a complete list of hazardous chemicals that may be used at the Project site along with a copy of a Safety Data Sheet (SDS) for each. Copies of any subsequent SDS amendments, additions, or corrections shall also be promptly submitted. Additionally, a list of the chemicals that are on site is to be submitted to The Christman Company.

The Christman Company will maintain a master file of all jobsite SDS' for every subcontractor in the on-site Project office. This information will be made available to any employee upon request.

It is the responsibility of each subcontractor to provide proper and adequate employee training as required under this Act.

Compliance with the storage, use and disposal requirements as outlined on labels and SDS's is mandatory for all users; full understanding of these requirements is expected of all users and suppliers of hazardous materials.

IX. Existing Hazardous Material

The Christman Company Site Manager and / or Superintendent and Owner/Client shall review all areas of the Project site for existence of hazardous materials, such as asbestos and lead. If asbestos exists in areas that involve construction work, the Owner/Client shall arrange to remove the asbestos before any construction work takes place in each area.

If lead-based paint exists in areas, which involve construction work, each Subcontractor working in the areas shall be responsible for complying with the requirements of the OSHA standard for lead exposure. The recognition of possible contaminated areas is key to avoiding

exposure. If you discover an area that you suspect lead may be present you are to bring it to the attention of The Christman Company Project Superintendent.

Proper communication regarding the hazardous materials is to be conveyed to all people that may possibly be exposed to the hazard.

Remember - If a suspect hazardous material is discovered notify The Christman Company's Project Superintendent immediately.

X. Personal Protective Equipment and Clothing

Each subcontractor shall supply each of their workers with the proper safety equipment, take any necessary precautions to maintain the equipment according to current regulations and specifications and accept responsibility to assure that proper safety equipment is used when required. All workers shall be required to wear appropriate personal protective equipment and clothing where there is an exposure to hazardous conditions and where needed to reduce hazards to the worker. The following list represents the minimum requirements:

A. Outer Garments

1. Suitable outerwear is defined as clothing designed to protect from expected hazards. Outer garments should be well fitting. Short sleeve garments may be worn where no hazards to exposure exist. **High Visibility Shirts or Vests must be worn at all times.** For daytime and nighttime work within the right-of-way, apparel shall be labeled as meeting the requirements of ANSI 107-1999 standard performance for Class 2 risk exposure. For the same condition described above but the activity is flagging traffic, a type 3 is to be used.

Tank tops or "muscle shirts" are not permitted. Full pants are to be worn. Neckties should not be worn when working around moving machinery. All employees are to avoid loose sleeves, frills or trims that could present hazards. Racist or profane slogans on outer garments are not permitted.

B. Gloves
Hands are to be protected as dictated by working conditions. Gloves, mittens or hand leathers will be of the type consistent with the hazards present.

C. Hardhats
Hardhats must be worn on site at all times. Acceptable hardhats must meet the requirements of ANSI Standard Z89.1 – Type 1 Class E.

D. Eye and Face Protection
   A. Safety glasses are required at all times. Acceptable safety glasses must meet the requirements of the most current ANSI Standard Z87.1.
   B. Employees shall be required to wear proper eye and face protection during operations where a hazard or risk of injury exists from flying objects or particles, harmful contacts, exposures such as glare, liquids, injurious radiation, electrical flash, or a combination of these hazards.

C. Contact lenses or US food and drug administration standard hardened lenses shall not be considered as eye protection.

D. An employee who needs corrective lenses in spectacles where eye protection is required shall be protected by one of the following:
   a. Spectacles whose protective lenses provide optical correction.
   b. Goggles that can be worn over the corrective lenses without disturbing the adjustment of the spectacles.
   c. Goggles that incorporate corrective lenses mounted behind the protective lenses.

E. Face and eye protection equipment shall be of proper size to fit the employee and protect against the intrusion of foreign objects. Face and eye protection shall be kept clean and in good repair. Equipment with structural or optical defects shall not be used.

F. Face shields and goggles shall be used, as required, to provide eye and face protection when safety glasses are insufficient.

G. Employees shall wear welding helmets with filter lenses when engaged in welding, cutting, or burning operations or the employee shall wear safety glasses with side shields or goggles under the shield when the shield is raised and is exposed to flying objects. Manufactured welding shields shall be placed around the work area to prevent flash exposure to other employees.

E. Jewelry

Bracelets, necklaces, rings and earrings are not to be worn during operations where they present hazards to the wearer.

F. Foot Protection

Work boots or approved safety shoes are to be worn at all times on the project. Special safety footwear for protection against exposure to electrical shock, chemicals, acids, caustics, and hot or molten materials may be required and it is the responsibility of the employer to provide their employees with the appropriate "special footwear" if it is deemed necessary. If an employee is using a Jack Hammer toe guards are required.

G. Personal Protective Equipment

The use of personal protective gear, such as gloves, respirators, coveralls, safety glasses, ear protection, and the like, will be required as conditions demand and shall be reviewed at the time of employee orientation or when assigning duties. The contractor is required to supply all required PPE to their employees.

H. Respirators

Any Subcontractor responsible to perform work that requires respiratory protection shall have a written respiratory program in place. A copy of the program shall be submitted to The Christman Company's Superintendent before commencement of any work activities that require the use of respirators. At a minimum, each respiratory protection program shall provide each employee with training relative to the need for use, fitting, fit testing, cleaning and storage of respirators.

I. Fall Protection

Policy: Fall protection shall be worn and used, 100% of the time, by all persons when there is exposure to a fall greater than six (6) feet unless other provisions such as guardrails, safety nets, or fall restraints have been provided. This includes, but is not limited to, steel erection (including connecting, bolting-up, decking, welding or any other steel erection activity), precast erection, roofing activities and masonry work including overhand laying operations.

Exceptions: The safe use of ladders up to twenty-four (24) feet in length.

Unacceptable means of compliance: Safety monitors.

Example of an acceptable means of compliance: A warning barrier fifteen (15) feet from the potential fall hazard. The exception to this will be for roofers performing roofing activities. They will be allowed to move closer to the edge and establish their warning barrier at six (6) feet. Anyone required to cross the fifteen (15) foot or six (6) foot barrier line must comply with the fall protection policy. The barrier shall consist of ropes, chains or wires supported by stanchion posts erected as follows:

- The system shall be flagged at no more than six (6) foot intervals with a high-visibility material.
- The system shall be rigged and supported in such a way that its lowest point (including sag) is no less than thirty-four (34) inches from the walking/ working surface and its highest point is no more than thirty-nine (39) inches from the walking / working surface.
- After the system is erected, the stanchions shall be capable of resisting, without tipping over, a force of at least sixteen (16) pounds applied horizontally against the stanchion, thirty (30) inches above the walking / working surface, perpendicular to the warning line, and in the direction of the floor, roof or platform edge.
- The system line shall have a minimum tensile strength of 500 pounds and after being attached to the stanchions, shall be capable of supporting without breaking, the loads applied to the stanchions noted in the above item.
- The line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

XI. Emergency Telephone Numbers

Emergency telephone numbers for the ambulance, hospital, fire department, and police shall be posted in each jobsite office at each phone. Each contractor shall furnish The Christman Company with the emergency contact phone numbers for all key project personnel (e.g. jobsite supervisors, project managers, foreman, etc.). Contact numbers shall include mobile home,

pager and other phone numbers available and necessary to access key personnel in the event of a project emergency. Distribution of these numbers will be limited and considered confidential.

XII. First Aid

Each subcontractor shall provide The Christman Company with the name or names of each designated first-aid certified worker. Each subcontractor is required to have at least one (1) certified worker on site during periods when the subcontractor is active.

The Christman Company will have a first aid kit on site at the Project office. Each subcontractor shall also provide a first aid kit on site.

XIII. Injury/ Accident Reporting and Investigation

Any worker incurring an injury while working at the **Willow** Project site shall report the injury to his supervisor immediately. **All injuries shall be verbally reported to The Christman Company the day of the incident/accident, followed up in writing on the proper forms, within twenty-four (24) hours.** Each incident/accident shall be documented using an accident investigation report similar to The Christman Company report (refer to Attachment II). In the event of an accident, the following steps shall be taken:

A. Make sure that accident victim receives appropriate medical attention. This may involve calling paramedics, arranging transportation to a hospital, or sending victim to a clinic depending on severity of injury.
B. Notify The Christman Company's Superintendent immediately regardless of the seriousness of the incident or accident. This includes property damage.
C. Perform a thorough investigation of all facts and circumstances surrounding the accident. This should include:
    1. Photographs of the accident site and any other pertinent areas or conditions, which document the circumstances existing at the time of the accident.
    2. Determine who, if anyone witnessed the accident. Obtain names, addresses and phone numbers and get written statements from them as to what they saw and any other facts they may be aware of regarding the accident and its cause.
    3. Interview the accident victim to hear his/her explanation of how the accident occurred.
    4. Fully complete an accident investigation report and submit a copy to The Christman Company's Superintendent.

All accidents resulting in property damage shall be reported immediately to The Christman Company Project Superintendent in order to allow for documentation of the extent of damage and determination of any required corrective action.

XIV. Assured Grounding Program

This program may be used to ensure that the scheduled inspection and safety condition of construction electrical equipment grounding conductors is satisfactory. The program applies to all extension cords and receptacles not part of the permanent building or structural wiring.

A. Inspection Procedure
The inspection procedure for all extension cords, attachment caps, plug/receptacle sets and equipment powered by a plug-in cord will include visual inspection at the beginning of each shift for signs of damage, defects, missing pins or insufficient insulation. Defective equipment will be removed from service until repaired and / or replaced.

B. Test Procedure
The test procedure for all extension cords and receptacles that are not permanent wiring includes testing for electrical conduction and correct attachment to the equipment ground conductor. The frequency of these tests will be as follows:

1. Prior to the first use.
2. Before equipment is returned to service following any repairs.
3. Before equipment is used following an incident which may have resulted in equipment damage.
4. At intervals not exceeding three months. Quarters and tape color should be coded following inspection. Winter (January through March) will be coded in white; Spring (April through June) will be coded in green; Summer (July through September) will be coded in red; and Fall (October through December) will be coded in brown.

Testing for each quarter is expected to occur between 15 days prior to and 15 days after the beginning of that quarter.

Each subcontractor is responsible for assigning a properly qualified person to coordinate their Assured Grounding Program and ensure compliance with this procedure and any other applicable codes and regulations.

Other forms of testing will be accepted as long as the record documentation of the testing can be provided upon request.

XV. General Jobsite Safety Rules

Violation of any of the following general jobsite safety rules is considered to be extremely serious and a detriment to the safety and welfare of all workers. Violation of these safety rules will be cause for disciplinary action up to and including permanent removal from the project.

A. Report all injuries to the field office. Get first aid promptly.
B. Keep your mind on your work at all times. No horseplay on the job.
C. Personal safety equipment must be worn as prescribed for each job, such as: safety glasses for eye protection when sawing or chipping concrete or masonry; hard hats at

all times within the confines of the Project site; gloves when handling materials that are harmful to the skin; safety shoes for protection against foot injuries – no tennis shoes, sneakers, or other light duty shoes.

D. Keep your shirt on to prevent sunburn and to protect against acid burns, steam burns, weld splatter and cuts. Minimum clothing for upper body is a "T" shirt. Legs to be protected by long pants – no shorts allowed.
E. If any part of your body should come in contact with an acid or a caustic substance, rush to the nearest water available and flush over the affected part. Secure medical aid as soon as possible.
F. Watch where you are walking. Don't run.
G. The unauthorized use, sale, possession or distribution of alcohol, narcotics, drugs or controlled substances while working or working while under the influence of these substances is prohibited.
H. Do not distract the attention of fellow workers – to do so may cause injury.
I. Sanitation facilities are provided for your use. Use them.
J. Good housekeeping is a must. Keep your work area free from rubbish and debris. Keep materials, tools, and equipment in a neat and orderly fashion.
K. Do not use a compressor to blow dust or dirt from your clothes, hair, face, or hands.
L. Use a respirator when working on operations where dust or fumes are present.
M. Never work aloft if you are afraid to do so, are subject to dizzy spells, or if you are apt to be nervous or sick.
N. In case of injury to a fellow worker, go for help. Never move an injured person unless it is absolutely necessary – further injury may result. Keep the injured as comfortable as possible and utilize jobsite first aid supplies until medics arrive.
O. Know where firefighting equipment is located and learn how to use it.
P. Learn to lift correctly – with the legs, not the back. If a load is too heavy, GET HELP.
Q. Riding material hoists, crane ball, and sideboards or with your legs dangling over the ends or sides of trucks is not permitted.
R. Do not use power tools and equipment until you have been properly instructed in their use and operation. Be sure that all guards are in place. Do not remove, displace, damage, or destroy any safety device or safeguard furnished or provided for use on the job, nor interfere with the use thereof.
S. Rope off or barricade danger areas. Do not enter an area, which has been roped off or barricaded.
T. If you must work around backhoes, cranes, trucks, and dozers, make sure operators are aware of your presence. All mobile equipment must have backup alarms.
U. Never oil, lubricate or fuel equipment while it is running or in motion.
V. Trenches 4 ft. in depth must have a ladder and over 5 ft. must be shored or sloped as required. <u>Keep out of trenches or cuts that have not been properly sloped or shored</u>. Inspect trenches and banks daily. Backfill material must not be stored closer than two feet from top of bank.
W. Use the "four and one" rule when using a ladder – one foot of base for every four feet of height. Always secure the bottom of the ladder with cleats and/or safety feet. Lash off the top of the ladder to avoid shifting. Ladders must extend three feet above a landing for proper use. Defective ladders must be properly tagged and removed from service.

X. Erect scaffolds according to manufacturers' recommendations.
Y. Use only extension cords of the three prong type and protected with a GFCI.
Z. The use of fall protection with safety lines when working from unprotected high places is mandatory. Always keep your lines as tight as possible.
AA. Never throw anything "overboard". Someone may be passing below.
AB. Open fires are prohibited.
AC. Floor perimeter and floor openings shall be properly guarded at all times. Perimeter cabling must be flagged. All covers for floor openings must be secured and marked, "Hole Cover Do Not Remove". A "hole" means a gap or void 2 inches or more in its least dimension, in a floor, roof, or other walking/working surface. Note – this includes mechanical and electrical sleeves.
AD. All personnel operating a manlift or forklift must be certified.
AE. No radios, MP3 players or personal listening devices are allowed on site.

XVI. Housekeeping

A clean work place is a safe work place. Every subcontractor and worker shall be responsible to adhere to the following housekeeping guidelines:

A. Pick up and dispose of trash and debris on a daily basis. A sufficient number of trash receptacles shall be provided and emptied with regularity.
B. **Work areas are to be kept clean, orderly and floors are to be swept daily.**
C. Leads, hoses, and extension cords shall be hung up with a nonconductive material, off all floors, stairways, and walkways.
D. Trash such as drinking cups, cans, and scraps from lunch are not to be thrown down, but disposed of properly in marked containers.
E. Materials, equipment, concrete forms, pipe, etc., are to be orderly stacked so as not to obstruct walkways, doors, stairways, ladders, other points of access or egress, etc.
F. Oil, grease, and other such liquid spills shall be cleaned up at the time of spill and are not to be left unattended.
G. Participation in mandatory cleanup programs if the project requires it.

XVII. Ancillary Safety Procedures

A. Lockout/Tagout – a procedure for cutting off all sources of energy or flow of medium to a piece of equipment or system. Refer to Attachment III.
B. Confined Space Entry – a procedure to assure that workers who perform work in a confined space is protected. Refer to Attachment IV.
C. Cranes – all cranes and cable (wire rope), rigged hoisting equipment shall have a current annual inspection by an accredited agency prior to working at this site. Contractors also are required to maintain a current annual inspection for the duration of the work. An accredited agency is a third party, which is recognized by the Department of Labor, Occupation Safety and Health Agency. A copy of the annual certification must be submitted to the respective general contractor immediately upon arrival on site. Rigging must be inspected and have required capacity tags.

D. Powder-Actuated Tool Operator – each powder-actuated tool operator will be certified in accordance with OSHA requirements. Operators will carry their certification card on their person while operating powder-actuated tools.

F. Hole Covers – Any contractor / trade that creates or exposes a hole or opening in a floor or wall is responsible to immediately protect the opening in accordance with OSHA regulations. At a minimum the hole is to be protected by barricades or a secured cover that is sufficient in strength to support any potential load that may be imposed. Additionally, anyone who removes a hole cover is responsible to protect the area while the exposure is present and to re-secure the cover or protection once the work is completed for that shift.

XVIII. Tobacco Use Protocol

Smoking and the use of all other tobacco products, is strictly prohibited within the boundaries of the Willow project. The use of any tobacco product will be permitted off site. Violation of this policy will be cause for disciplinary action up to and including permanent removal from the project.

XIX. Crane Inspections

Each crane used at the Project site shall have a current annual crane inspection report, which documents that the crane has been inspected within the current year in accordance with established OSHA standards.

XX. Visitor Policy

All visitors to the Project site must report to The Christman Company Project Office upon arrival. All visitors shall comply with the policies and procedures of this Project Safety Manual while on site. Visitors are required to watch The Christman Company safety orientation video and sign the visitor release form. Visitors not sufficiently familiar with the jobsite shall be accompanied at all times by employees familiar with the Project. Visitors must wear a hardhat, Hi-Visibility shirt or safety vest, and proper footwear at all times while on site. Other PPE such as safety glasses are to be worn when the conditions warrant such protection. The contractor requesting approval of the visitor is responsible to issue the proper PPE that may be required.

XXI. Fire Prevention and Protection

A. Fire Prevention

1. Housekeeping
   Proper Housekeeping practices by all subcontractors will help to establish and maintain free and unobstructed egress from the project site. Housekeeping of the project is to be maintained by all subcontractors performing work on the site. It is each subcontractor's responsibility to report areas of the jobsite that present a likelihood of fire to The Christman Company superintendent. Depending on the

type of construction and the participation of the subcontractors in daily housekeeping efforts, The Christman Company may create and enforce a mandatory cleanup policy that will be adhered to by all subcontractors.

2. Storage of Flammable and Combustible Liquids

A. General Requirements

1. Only approved containers and portable tanks will be used for storage and handling of flammable and combustible liquids.
2. Approved metal safety cans will be used for handling and use of flammable liquids in quantities greater than one gallon. Plastic containers are prohibited. Flammable liquid materials may be used and handled in original shipping containers.
3. For storage, use and handling of flammable liquids in quantities of one gallon or less, only the original container or approved metal safety cans may be used.
4. Flammable or combustible liquids are not to be stored in areas used for exits, stairways or other high-traffic areas.
5. No storage of flammable or combustible materials is to occur on any roof.

B. Indoor Storage

1. No flammable materials may be stored inside.
2. Materials, which will react with water and create a fire hazard, shall not be stored in the same room with flammable or combustible liquids.

C. Outdoor Storage

1. All storage areas are to be created as to prevent the contamination of surrounding areas in the event of a spill. Proper consideration is to be given to the runoff of rainwater vs. the control of spilled or leaking materials.
2. Containers less than 60 gallons in size are to be placed in areas not to exceed a total of 1,100 gallons. Containers are to be separated by a five feet clearance and will not be nearer than 20 feet to a structure.
3. Portable tanks will not be nearer than 20 feet from any structure.

D. Gas and Oxygen Bottles

1. Full and/or partially used compressed gas cylinders must be attached to approved carts and turned off after each use.
2. All compressed gas cylinders regardless of content amount (full, partially full or empty), shall be properly stored and secured in the area designated by The Christman Company.

3. Valve protecting caps shall always be in place when cylinders are not connected for use.
4. When moving a cylinder, be sure to remove all gauges prior to the move. Be sure to use a rack when lifting a cylinder to and from upper elevations. Never move a cylinder by rolling it or by dropping it down to lower elevations.
5. Oxygen cylinders must be stored 20 feet away from fuel cylinders or separated by a solid 1- hour divider. Storage is considered as not being used within the next shift of work or 24-hour period, which is ever shorter. Oil and grease must be kept away from oxygen cylinders.
6. Compressed gas cylinders shall be legibly marked with the chemical or trade name of the gas. Marking shall be by stenciling, stamping, or labeling and shall not be readily removable.
7. All L.P.G. not connected for use must be properly stored in the designated area. NO EXCEPTIONS!

E. Temporary Heat

1. Temporary heaters must be installed and serviced by authorized technicians only.
2. Housekeeping in the area of the heater is extremely important and all subcontractors are responsible to insure that no materials are stored near the heater or in such a fashion that they may create a hazardous condition.
3. All temporary fuel burning heaters are to have functioning safety valves that will eliminate fuel flow in the event of flame outage.
4. If a heater is to operate for an extended period of time it must have a daily scheduled inspection to insure that it is operating correctly and that the area is clear of possible obstructions.
5. The Christman Company superintendent may assign maintenance, operation, and inspection responsibilities to a subcontractor.
6. All subcontractors are responsible to notify The Christman Company immediately in the event of a malfunctioning heater or potential for a hazardous condition.

F. Hot Work Operations and Permit Procedures

Many of Christman projects are within existing operating facilities. Clients may have established procedures at their facilities to ensure all safety precautions have been taken prior to initiating operations involving Hot Work. Additionally, Hot Work permits may be issued by Client operations personnel to control the work within operating areas and ensure that operator/maintenance/construction personnel are aware of client required safe work practices. It is the responsibility of all personnel entering client controlled operating areas to obtain the proper Client authorization and appropriate work permits. The Christman Company shall be informed of any intended Hot Work prior to initiating. The

Christman Company will coordinate our Hot Work permitting program with any other existing program being implemented by the Client. Regardless if the Client has a Hot Work procedure, NO Hot Work shall take place without first coordinating with The Christman Company.

The purpose of this procedure is to eliminate the potential for injury to personnel and damage to equipment and property due to fire, sparks, heat or explosion resulting from cutting, welding and similar hot work.

A "Hot Work Permit" will be required by The Christman Company when using any equipment, tools or apparatus capable of generating heat, sparks or flames in any restricted areas; enclosed interior areas or as determined by the project superintendent or site safety manager (Refer to attached Hot Work Permit). The Christman Company, through designation of a Permit Authorizing Individual (PAI), will ensure adherence to this Hot Work permit procedure. Failure to comply with this Hot Work Permit procedure may result in immediate and permanent removal from the project. The discipline policy as described in section IV of the project specific safety manual will be enforced.

Upon issuance of the proper work permit by Christman or the Client's representative, the PAI shall completely perform the required actions indicated on the permit, check all boxes on the permit, and sign off on it. The PAI shall print their name and sign the work permit verifying he has reviewed the permit and understands the limitations and requirements within.
Upon receiving the permit, it is the responsibility of the PAI to review the permit with his employees/crew explaining the precautions and limitations of the proposed task and assure that the permit system is implemented correctly.

The following conditions apply to all hot work permits:

- The contractor will be responsible for providing all the required training, materials, personnel and protective equipment to conduct all hot work.
- Contractor personnel who perform fire watch duties must be trained to perform the task and trained to use a fire extinguisher.
- A permit is not valid for more than one shift. In any case, the duration of the Hot Work Permit shall not exceed 12 hours. A new permit is to be issued if the job/task duration exceeds 12 hours.
- Prior to starting operations, the working areas and any levels below must be reviewed to assure that flammable material and equipment has been removed from harm's way.
- Adjacent contractors have been informed of the impending hot work.
- Contractor supplied firefighting equipment must be in place and readily available for worker use.
- A restricted zone must be established outside of the working area and at any areas levels accessible below.
- A fire watch must be established and maintained for a designated period after hot work has been completed. The duration of the fire watch is dependent

upon the type of hot work being performed and the working area. Fire watch can range from one (1) to two (2) hours.

- Hot work permits must be prominently displayed within the hot work area and available for review. Workers assigned to fire watch duty must be readily identifiable and within the area. Fire watch must be maintained through break and lunch periods.

Occasionally Special conditions may apply to hot work permits, based on the environment of the work area and the type of operations being performed. Special conditions to the permit may include the following:

- Fume monitoring and control measures.
- Flame retardant ground and wall coverings.
- Extended fire watch
- Dosing or spray down of work areas after hot work completion.
- Use of smoke and carbon monoxide detectors.
- Oxygen and gas monitoring.

Hot work permits are to be collected by the PAI at the expiration of the permit, conclusion of task or end of shift. After the permit has been closed out they are to be submitted to The Christman Company superintendent or site safety manager for review.

Copies of the permit will be retained by The Christman Company for the duration of the project.

B. Fire Protection

1. A means of egress shall be established and maintained. Each subcontractor is responsible to notify The Christman Company if the means of egress is not obvious or if it is obstructed.

2. The rules for evacuation will be posted on the project bulletin board area adjacent to the other OSHA required postings. If the location of the work is such that posting of the rules is not feasible, a copy of the rules and a map of the evacuation route (if applicable) will be given to each subcontractor working on the project. It is the responsibility of each subcontractor to make their employees aware of any such posted or otherwise conveyed rules, maps or procedures for the safe and orderly evacuation of the project.

3. Emergency phone numbers shall be posted next to each phone in the jobsite trailer or office.

4. Firefighting equipment shall be provided by the subcontractor for protection of their employees. In some cases, The Christman Company may provide "common area"

protection. Each subcontractor is to coordinate their efforts to comply with this rule with The Christman Company superintendent. Defective equipment shall be immediately replaced and brought to the attention of The Christman Company superintendent.

5. Fire walls and exit stairways required for the completed buildings are given construction priority. Fire doors with automatic closing devices shall be hung on openings as soon as practicable.

6. Retain existing fire separations in buildings undergoing alterations or demolition until operations necessitate their removal.

C. Employee Emergency Action Plan

The Christman Company's project superintendent shall be the person in command in the event of a fire or other emergency. It shall be his responsibility to oversee that employees are evacuated and the emergency response team is notified. The superintendent shall designate another employee as second in command. Fires and other emergencies shall be reported to the superintendent immediately. All employees are required to familiarize themselves with the evacuation plan for the site and with the designated contacts for emergency response team.

In the event of a fire or other emergency, employees shall evacuate the building through the nearest exit after determining it is safe to do so. Upon exit from the unsafe area, the employee should contact his superintendent and coordinate efforts to call the emergency response team (911). Each foreman or superintendent is responsible for a head count of their employees after evacuation. The Christman Company superintendent is to be notified of any missing employees.

If critical operations must be conducted or continued within or near an unsafe area during a fire or other emergency and the superintendent deems that limited activity may continue in the area, the superintendent shall establish a plan to monitor those employees in the unsafe area as well as a way to quickly evacuate them should the conditions become worse. If monitoring and quick evacuation are not possible, the operations shall be abandoned until conditions improve.

All employees are responsible for the joint welfare of all other employees. During evacuation, ambulatory employees trained in first-aid/CPR are responsible to assess the conditions of non-ambulatory employees and assist in their evacuation. Employees who cannot be moved must be reported to the superintendent upon evacuation.

PROJECT SAFETY MANUAL

SUBCONTRACTOR AND TRADE CONTRACTOR ACKNOWLEDGEMENT

I hereby acknowledge receipt and comprehension of the policies and procedures set forth in this Manual and agree to comply with its directives.

In addition, I hereby agree to comply with any field or trade-related guidelines as they apply to the portion of work for which I have been contracted and will incorporate them into the ongoing safety effort. I also understand and agree to comply with any State and Federal OSHA and ANSI regulations, standards, codes and rules as they apply to my portion of the work.

_____
(Signed)

_____
(Print Name)

_____
(Title)

_____
(Company Name)

_____
(Date)

Please sign and fill out the information requested above and return to The Christman Company.

Drug Screening List

A. Any employee injured at the project site and needing offsite medical attention will be tested for alcohol and drugs. If the injured party was hurt by the action of another person who was not injured, this person must also submit to substance abuse testing. An employee who tests positive for illegal substances or alcohol will not be allowed to return to the project site. Any employee who refuses to submit to substance abuse testing after an injury/accident which involves offsite medical attention will not be allowed to work at the project site.

Notes:

a. All staff/trades working at the project site shall be subject to the provisions of this program. Visitors and delivery personnel are not included.
b. Substance abuse testing shall include the drugs listed in c (below) and alcohol.
c. The drug-screening test shall include testing for amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, methadone, methaqualone, opiates, phencyclidine, and propoxyphene. Refer to the following listing, commonly referred as a Panel 10 Drug Screening:

DRUG GROUP	COMMON NAME	DRUG OR METABOLITE DETECTED
Amphetamines	Speed, Eve, Crystal	Amphetamines, Methamphetamines
Barbiturates	Secobarbital, Pentobarbital, Phenobarbital, Butabarbital	Diverse
Benzodiazepine	Valium, Librium	Oxazepam
Cannabinoids	Marijuana, Pot, Smoke, Weed, Mary Jane, Ganja	Delta-9-THC-9-COOH
Cocaine	Coke, Blow, Crack, Tool	Benzoylecgonine
Methadone	Methadone, Met	Methadone
Methaqualone	Quaalude, Ludes	Methaqualone
Opiates	Morphine, Codeine, Heroin, Horse	Codeine, Morphine
Phencyclidine	PCP, Angel Dust, Acid, Ecstasy	PCP
Propoxyphene	Darvon	Propoxyphene

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ATTACHMENT II

ACCIDENT INVESTIGATION REPORT

Employee Name _____ Date of Birth _____
Home Street Address _____ Male or Female _____
City, State, Zip _____ Date Hired _____
Home Phone _____ Date of Injury or Illness _____
Emergency Phone _____ Time Employee Began Work _____
Case # From Log _____ Time of Event _____

If a subcontractor on job, please fill out the following information:

Employer Name _____ Position _____
Work Comp Insurance _____ Policy # _____

Project Name & Location _____ Project # _____

Did injury result in a fatality? _____ Date of Death _____ Did injury result in lost time? ____ # of Days of Lost Time _ _____

Drug test given? _____ Did injured seek medical attention offsite? _____ Name of Physician _____
Name and address of facility _____
Was person treated in emergency room? _____ Was person hospitalized overnight as in-patient? _____

What was injured doing just before incident occurred? (Describe activity as well as tools or equipment used. Be specific.)

_____
_____

Describe the injury. (Be specific: cut, fracture, burn, strain, body part affected.)

_____
_____
_____

Describe events causing injury. (who, what, where, when, why, how)

_____
_____
_____

Identify unsafe acts, conditions, contributory factors, environmental conditions.

_____
_____

Witnesses to accident. (name, address, phone number)

_____
_____

Describe steps taken to prevent future accidents of this nature.

_____
_____

Severity Potential: _____ Major _____ Serious _____ Minor Have similar accidents occurred before? _____

_____ _____
Superintendent Signature & Date Injured Signature & Date

Date: May 8, 2014

Lockout/Tagout Procedure

Requirement

Whenever service, maintenance, or inspection is performed on machines, equipment, electrical circuits, or systems, it must be done with the machine, equipment, electrical circuit, or system stopped and isolated from all sources of energy or flow of medium. The energy isolation device(s) or isolation values for that machine, equipment, electrical circuits, or systems must be locked out and tagged out in accordance with a documented procedure. Employees involved in the energy control program must be given training. When subcontractor employees are performing work at the Project site, they must coordinate with The Christman Company and any other employer to ensue that no employees are endangered. When a group of employees is performing a service, maintenance, or inspection activity, each employee must be afforded protection equivalent to the utilization of individual lockout/tagout.

Lockout/Tagout Procedure

This procedure establishes the minimum requirements for the lockout/tagout of energy isolating devices and flow isolation values whenever maintenance, servicing, or inspection is done on machines, equipment, electrical circuits, or systems. It shall be used to ensure that the machine, equipment, electrical circuit, or system is isolated from all potentially hazardous energy sources or flows, and locked out before employees perform any servicing, maintenance, or inspection where the unexpected energization or startup of the machine, equipment, electrical circuit, or system or release of stored energy/flow could cause injury.

All subcontractors are required to comply with the restrictions and limitations imposed upon them during the use of this procedure. All employees are required to perform the lockout in accordance with this procedure. All employees, upon observing a machine, piece of equipment, or system which is locked out to perform servicing, maintenance, or inspection, shall not attempt to start, energize, or use that machine, equipment, or system. Failure to follow this procedure will result in disciplinary action.

Sequence of Lockout

1. Notify all affected employees that servicing, maintenance, or inspection is required on a machine, equipment, electrical circuit, or system and that the machine, equipment, electrical circuit, or system must be shut down and locked out to perform the servicing, maintenance, or inspection.
2. The employee shall refer to any and all sources to identify the type and magnitude of the energy that the machine, equipment, or electrical circuit utilizes, shall understand the hazards of the energy, and shall know the methods to control energy. The type and source of medium which is flowing in a system to be worked on shall be identified and system isolation values located. All flows shall be stopped and the lines to be worked on purged prior to the commencement of work.

3. If the machine, equipment, or electrical circuit is operating, shut it down by normal stopping procedure (depress stop button, open switch, close valve, etc.).
4. Deactivate the energy isolation device(s) so that the machine, equipment, or electrical circuit is isolated form all energy sources. Close isolation values or shut down equipment which is used to provide flow to the system.
5. Lock out the energy isolation device(s) with assigned individual lock(s). Tagout isolation values and/or equipment.
6. Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
7. Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verifying the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

   CAUTION: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.
8. The machine, equipment, electrical circuit, or system is now locked and/or tagged out. The employee(s) that installed a lock shall apply tag(s) identifying who locked the piece out, the date, and the time.

Restoring Equipment/System to Service

When the servicing, maintenance, or inspection is complete and the machine, equipment, electrical circuit, or system is ready to return to normal operating condition, the following steps shall be taken:

1. Check the machine, equipment, or electrical circuit and the immediate area around the machine, equipment, or electrical circuit to ensure that nonessential items have been removed and the machine, equipment, or electrical circuit components are operationally intact.
2. Check the work area to ensure that all employees have been safely positioned or removed from the area.
3. Verify that the controls are in neutral.
4. Remove the lockout/tagout devices and re-energize the machine, equipment, or electrical circuit.
5. Notify affected employees that the servicing, maintenance, or inspection is complete and the machine, equipment, or electrical circuit is ready to use.

CONFINED SPACE ENTRY PROCEDURE

I. Definitions

A. Confined Space
Confined space means any space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen-deficient atmosphere. Confined spaces include, but are not limited to: storage tanks, tunnels, pipelines and open top spaces such as pits, tubs, vaults, caissons and vessels.

B. Hazardous Atmosphere
Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a permit space), and injury or illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL).
2. Airborne combustible dust at a concentration that meets or exceeds its LFL. Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of five (5) feet or less.
3. Atmospheric oxygen concentration below 19.5% or above 23%.
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published as subpart "G", Occupational Health and Environmental Control, or in subpart "Z", Toxic and Hazardous Substances which could result in employee exposure in excess of its dose or Permissible Exposure Limit.
5. Any other atmospheric condition that is immediately dangerous to life or health.

II. Owner/Client's General Requirements

A. The owner/client shall evaluate the work place to determine if any spaces are permit-required workspaces.
B. If the work place contains permit spaces, danger signs shall be posted at all points of entry to each space. Example: Danger, Permit Required Confined Space, Do Not Enter.
C. Identify the elements, hazards, and previous experience with each space that make it a permit space.
D. Identify any implemented precautions and procedures used by the owner/client to protect his employees in or near each space.

III. Subcontractor Requirements

A. Each subcontractor shall obtain any available information regarding permit space hazards and entry operations from the owner/client and coordinate employee entry operations in or near permit spaces.
B. Each subcontractor who performs any work in permit required work spaces shall be responsible to follow the requirements of this confined space entry procedure.

Each subcontractor shall provide training for each employee involved with work located in permit required work spaces.

C. Subcontractors must provide documentation that training has been given. Said documentation shall contain each employee's name, ID of trainer, and dates of training. Subcontractor employee duties relative to this procedure are as follows:

1. Entry Supervisors Duties
    a. Identify the need to implement this procedure.
    b. Responsible to follow the procedure requirements.
    c. Complete safe entry checklist.
    d. Complete a confined space entry permit for each 8-hour period.
    e. Knows, understands and insures training of the authorized entrants and attendants.
    f. Checks appropriate permit information, assuring all tests have been made and recorded. Knows the hazards that may be faced during entry, including mode information, signs or symptoms, and exposure consequences.
    g. Terminates the permit if required.
    h. Verifies rescue services are available.
    i. Removes unauthorized individuals from the permit space.

2. Attendant Duties
    a. Knows the hazards that may be faced during entry, including mode information, signs or symptoms, and exposure consequences.
    b. Is aware of possible behavioral effects of hazard exposure of entrants.
    c. Continuously maintains a count and identification of who is in the permit space. Verifies that all entrants have exited the confined space at the end of the work shift.
    d. Remains outside the space until properly relieved by another attendant.
    e. Monitors activities inside and outside the space to determine if it is safe for entrants.
    f. If the attendant detects behavioral effects of hazard exposure, he/she must be knowledgeable to:
        i. Summon rescue and other emergency services.
        ii. Warn authorized entrants.
        iii. Perform non-entry rescues.
        iv. Perform no duties that might interfere with the primary duty to protect authorized entrants.

3. Authorized Entrant Duties
    a. Know the hazards that may be encountered.
    b. Know how to properly use protective and emergency equipment required.

c. Know how to communicate with attendant.

IV. Procedures

A. General

All employees required to enter into a confined space shall be instructed in:

1. The nature of the hazard involved.
2. The precautions required.
3. The use of personal protective equipment and emergency equipment required. No employee shall be permitted to enter a confined space unless the following steps have been completed:
    a. A tested ventilation system is in place to ensure the removal of harmful gases, vapors, smoke, fumes, mists or dusts from within the confined space.
    b. The employee has been provided with and is wearing appropriate respiratory protective equipment.
    c. Where presence of toxic gas is suspect, appropriate gas tests shall be performed immediately prior to entry to determine the presence of any harmful gases, fumes, mists, vapors, smoke, dusts or an oxygen deficiency. Re-testing shall be done at least every four (4) hour intervals. During the presence of employees in the confined space, to ensure harmful concentrations of gases, vapors, smoke fumes, mists or dusts or any oxygen deficiency has not developed, gas test results shall be taken and logged.

B. Environmental Testing

Before entry into any confined space suspected of having mixtures or concentrations of flammable and/or toxic air contaminants or oxygen deficiencies, appropriate tests of the atmosphere shall be made by a qualified person to assure that, explosive limits are less than 10% LEL, that toxic gas levels (TLVs) as specified by established health data sheets are not exceeded and that oxygen concentrations are greater than 19.5% but less than 23% of the total air mixture.

A confined space found to have or suspected of having oxygen deficiency or exceeding flammable or toxic limits shall be:

1. Reported promptly to The Christman Company Supervisor on site.
2. Posted with the appropriate warning signs.
3. Ventilated or exhausted.
4. Re-checked by a qualified person prior to entry.

During inert gas welding, portable and/or fixed oxygen analyzers with visual/audible, alarms shall be provided in areas where oxygen deficient atmospheric conditions may

develop. Continuous oxygen monitors, equipped with alarms shall be provided in areas designated.

All monitoring and testing equipment shall be maintained in accordance with the manufacturer's specifications.

C. Personal Protective Equipment

Work and/or rescue equipment shall be immediately available at all times and shall be selected with the potential hazards or possible contingencies determining the equipment which may be required during the work operations.

Appropriate eye, face, and ear protection and the designated protective clothing shall be worn by employees exposed to physical hazards.

Where air sampling has determined that flammable or toxic limits have been exceeded or an oxygen deficiency exists and accepted engineering control measures such as general and local ventilation are not feasible, air supplying respiratory protection shall be worn.

Employees entering a confined space where a harmful or potentially harmful atmosphere exists, shall wear an approved safety harness attached to a life line which is attended at all times by another worker stationed outside the confined space entrance. The outside worker shall be equipped to be capable of immediately rescuing the worker in the confined space. A mechanical device shall be available to retrieve personnel from vertical spaces more than 5 feet deep.

When an employee enters a confined space from the top, the employee shall wear a safety harness, which will keep the individual in a vertical position if a rescue is required.

Where the work being performed requires more than one worker to enter the confined space, provisions shall be made to prevent safety lines or air hoses from becoming entangled.

Where air sampling has determined flammable or toxic limits have been exceeded or an oxygen deficiency exists, and acceptable engineering controls such as general or local ventilation is not feasible, appropriate respiratory protection for the identified hazards shall be worn.

D. Ventilation/ Exhaust

When ventilation is used as a control method in maintaining acceptable concentrations of flammable and toxic contaminants, this section will be used as a guide in the installation and operation of ventilation systems.

1. Ventilation/exhaust will be constructed, maintained and operated to ensure the required protection, by maintaining a volume and velocity of exhaust air sufficient to gather dusts, fumes, vapors or gases from the confined or enclosed space and to convey them to suitable points of safe disposal.
2. Periodic air sampling for flammable and toxic materials and oxygen deficiencies shall be performed before and during employee work assignments in the confined or enclosed space to ensure a safe environment is maintained.

E. Lighting/ Electrical

1. Lighting will be provided in areas where there is insufficient natural light.
2. For work areas that may contain concentrations that exceed safe limits of flammable or combustible materials, appropriate lighting systems such as explosion-proof fixtures, switches or equipment shall be used. All electrical equipment is to conform to article 500 of the National Electrical Code.
3. Emergency lighting shall be provided at all points of access and egress. When this is not practical, explosion-proof flashlights shall be provided to persons required to enter confined or enclosed spaces, which are subject to blackout.
4. In areas of high moisture, portable electric lighting shall be operated at a maximum of 12 volts.

F. Communications

Constant communications shall be maintained with all personnel in confined spaces by personnel outside those areas. This shall be accomplished by utilizing one or more of the following methods:

1. Visual surveillance
2. Voice communication
3. Telephone communication
4. Two-way radio communication

Note: Proper method(s) will vary depending on whether an explosive atmosphere exists.

G. Fire Protection

Fire protection shall be assured in confined spaces at all times. This shall be accomplished by adherence to the following:

1. Safe access and egress will be maintained at all times when work is being performed in a confined space. Access ladders, floors and components that are constructed out of combustible materials shall be protected, covered or wrapped with a flame-retardant material.
2. Flammable liquids (i.e. acetone, alcohol, etc.) must be stored in approved (UL or FM) flammable liquid containers or dispensers. The amount of such flammable

liquid(s) in a confined space shall not exceed the amount necessary to perform the work each day.

3. Properly rated fire extinguishers shall be immediately available. In instances where extreme fire potential exists, a charged fire hose shall be readily available for immediate use.
4. Cylinders containing oxygen, acetylene or other fuel gases shall not be taken into confined spaces.
5. All rags, brushes, wipes, gloves, etc. shall be stored in metal containers with lids.
6. A person shall be stationed during all welding, burning and heating operations to monitor for fires and to ensure that, during and after the work has ceased or at the end of a work shift, there are no fire conditions present. A thorough check of welding and cutting areas is to be made at the end of each welding operation to assure NO fires have been started.
7. All flammable gas equipment, hoses, torches, etc. shall be free of defects and are to be inspected prior to each use.
8. To eliminate the risk of fire in confined spaces because of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch shall be shut off whenever the torch is left unattended for long periods of time. Fuel gas and oxygen hoses shall be immediately removed from confined spaces before they are disconnected from the torch or other gas-consuming device, and at the end of each work shift.

H. Lockout Procedure

All lines, pipes or other conveyance of flammable and/or toxic materials into a confined space shall be positively locked out and tagged in accordance with the Project Lockout/ Tagout Procedure.

I. Recordkeeping Requirements

1. A safe entry checklist (example attached) shall be completed and reviewed with The Christman Company Supervisor on Site.
2. A properly executed confined space work permit (example attached) is to be obtained before work may begin in a confined or enclosed space. All entrances into the confined space shall be posted with a copy of the permit.
3. A file of sampling results will be kept for each confined space and will be maintained by The Christman Company Supervisor on Site.

J. Rescue

Whenever work is to be performed in a confined space, emergency rescue must be anticipated and a rescue plan developed. In the event of an emergency, The Christman Company Supervisor on Site will coordinate and work with emergency medical and rescue personnel. Rescue plans will encompass all foreseeable contingencies that might occur when working in confined spaces. The Christman Company Supervisor on Site

will be responsible for training employees in emergency procedures such as rescue and escape.

CHRISTMAN
SINCE 1894

Confined Space Safe Entry Checklist

DO NOT ENTER A CONFINED SPACE UNTIL YOU HAVE CONSIDERED EVERY QUESTION AND HAVE DETERMINED THE SPACE TO BE SAFE.

Description of confined space _____
Subcontractor involved _____ Date _____
Subcontractor Supervisor _____

YES	NO	
[ ]	[ ]	Is entry necessary?

TESTING

YES	NO	
[ ]	[ ]	Are the instruments used in atmospheric testing properly calibrated?
[ ]	[ ]	Was the atmosphere in the confined space tested?
[ ]	[ ]	Was oxygen at least 19.5% - not more than 23%?
[ ]	[ ]	Were toxic, flammable, or oxygen-displacing gases/vapors present?

- Hydrogen sulfide
- Carbon dioxide
- Carbon monoxide
- Other (list) _____
- Methane

MONITORING

YES	NO	
[ ]	[ ]	Will the atmosphere in the space be monitored while work is going on?
[ ]	[ ]	Continuously?
[ ]	[ ]	Periodically? (If yes, give interval:) _____

REMEMBER – ATMOSPHERIC CHANGES MAY OCCUR DUE TO THE WORK PROCEDURE OR THE PRODUCT STORED.

CLEANING

YES	NO	
[ ]	[ ]	Has the space been cleaned before entry is made?
[ ]	[ ]	Was the space steamed?
[ ]	[ ]	If so, was it allowed to cool?

VENTILATION

YES	NO	
[ ]	[ ]	Has the space been ventilated before entry?
[ ]	[ ]	Will ventilation be continued during entry?
[ ]	[ ]	Is the air intake for the ventilation system located in an area that is free of combustible dusts and vapors and toxic substances?
[ ]	[ ]	If atmosphere was found unacceptable and then ventilated, was it retested before entry?

ISOLATION

YES	NO	
[ ]	[ ]	Has the space been isolated from other systems?
[ ]	[ ]	Has electrical equipment been locked out?
[ ]	[ ]	Have disconnects been used where possible?
[ ]	[ ]	Has mechanical equipment been blocked, chocked, and disengaged where necessary?

[ ] [ ] Have lines under pressure been blanked and bled?

CLOTHING/ EQUIPMENT

YES NO

[ ] [ ] Is special clothing required (boots, chemical suits, glasses, etc.)? (If so, specify:) _____

[ ] [ ] Is special equipment required (e.g. rescue equipment, respirators, communications equipment, etc.)? (If so, specify:) _____

[ ] [ ] Are special tools required (e.g. spark-proof)? (If so, specify:) _____

RESPIRATORY PROTECTION

YES NO

[ ] [ ] Are MSHA/NIOSH-approved respirators of the type required available at the work site?

[ ] [ ] Is respiratory protection required (e.g. air purifying, supplied air, self-contained breathing apparatus, etc.)? (If so, specify type:) _____

TRAINING

YES NO

[ ] [ ] Have you been trained in proper use of a respirator?

[ ] [ ] Have you received first aid/CPR training?

[ ] [ ] Have you been trained in confined space entry and do you know what to look for?

STANDBY/RESCUE

YES NO

[ ] [ ] Will there be a standby person on the outside in constant visual or auditory communication with the person on the inside?

[ ] [ ] Will the standby person be able to see and/or hear the person inside at all times?

[ ] [ ] Has the standby person(s) been trained in rescue procedures?

[ ] [ ] Will safety lines and harness be required to remove a person?

[ ] [ ] Are rescue procedures available and can they be followed in the event of an emergency?

[ ] [ ] Are you familiar with emergency rescue procedures?

[ ] [ ] Do you know who to notify and what to do in the event of an emergency?

PERMIT

(This permit is an authorization in writing that states that the space has been tested by a qualified person, that the space is safe for entry; what precautions, equipment, etc. are required; and what work is to be done.)

YES NO

[ ] [ ] Has a confined space entry permit been issued?

[ ] [ ] Does the permit include a list of emergency telephone numbers?

REVIEWED: _____ DATE: _____

The Christman Company

CHRISTMAN
SINCE 1894

Confined Space Entry Permit
(Permit valid for 8 hours only)

Site Location and Description	Date:
	Time: AM/PM
Purpose of Entry	Expires: AM/PM
Name of Employer (Subcontractor)	

SUPERVISOR(S) IN CHARGE OF CREWS	TYPE OF CREW	PHONE NUMBER

Italic print areas denote minimum requirements to be completed and reviewed prior to entry

REQUIREMENTS COMPLETED	DATE	TIME	REQUIREMENTS COMPLETED	DATE	TIME
Lockout/De-Energize/Tryout			***Full Body Harness with "D" Ring***		
Line(s) Broken/Capped/Blanked			***Emergency Escape Retrieval***		
Purge/Flush/Vent			***Life Lines***		
Ventilation			Fire Extinguishers		
Secure Area (Post and Flag)			Lighting (Explosive Proof)		
Breathing Apparatus			Protective Clothing		
Resuscitator/Inhalator			Respirator(s) Air Purifying		
Standby/Safety Personnel			Burning and Welding Permit		

Note: Items that do not apply, enter N/A in the box. ***Record continuous monitoring results every 2 hours.**

CONTINUOUS MONITORING TEST(S) RESULTS:	PERMISSIBLE ENTRY LEVEL	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:
Percent of Oxygen (O_2)	19.5% - 23.5%						
Lower Exposure Limit (LEL)	Under 10%						
Carbon Monoxide (CO_2)	+35 PPM						
Hydrogen Sulfide (H_2S)	+10 PPM						
Other							

NOTE: "+" denotes 8-hour time weighted average. Employee can work in area 8 hours (longer with appropriate respiratory protection).

ATTENDAT/GAS TESTERS	INSTRUMENT USED	MODEL AND/OR TYPE	SERIAL OR UNIT NO.

Attendant Standby Person is Required for all Confined Space Work

NAME OF CONFINED SPACE ENTRANTS(S)	NAME OF CONFINED SPACE ENTRANTS(S)

Supervisor Authorizing Entry: _____ Emergency Phone Number: _____

Reviewed by: _____
The Christman Company

Issue Date: 0/00/2014

IN CASE OF EMERGENCY CALL 9-1-1

NON-EMERGENCY CONTACTS

Emergency	Responder	Location	Phone
Fire	Lansing Fire Department	120 E. Shiawassee Street Lansing, MI 48933	(517) 483-4200
Police	Lansing Police Department	120 W. Michigan Avenue Lansing, MI, 48933	(517) 483-4600
Hospital	Sparrow Hospital	1215 E. Michigan Avenue, Lansing MI 48933	(517) 364-1000

Directions to Hospital: INSERT DIRECTIONS. Report to the hospital registration/information desk or the emergency room in the event of an emergency.

ADDITIONAL PHONE CONTACTS

Lansing Board of Water & Light (Electricity)	(517) 702-6006
Consumers Energy (Gas)	(800) 805-0490
Lansing Board of Water & Light (Water & Sewer)	(517) 702-6006

NON-EMERGENCY CONTACTS

The Christman Company

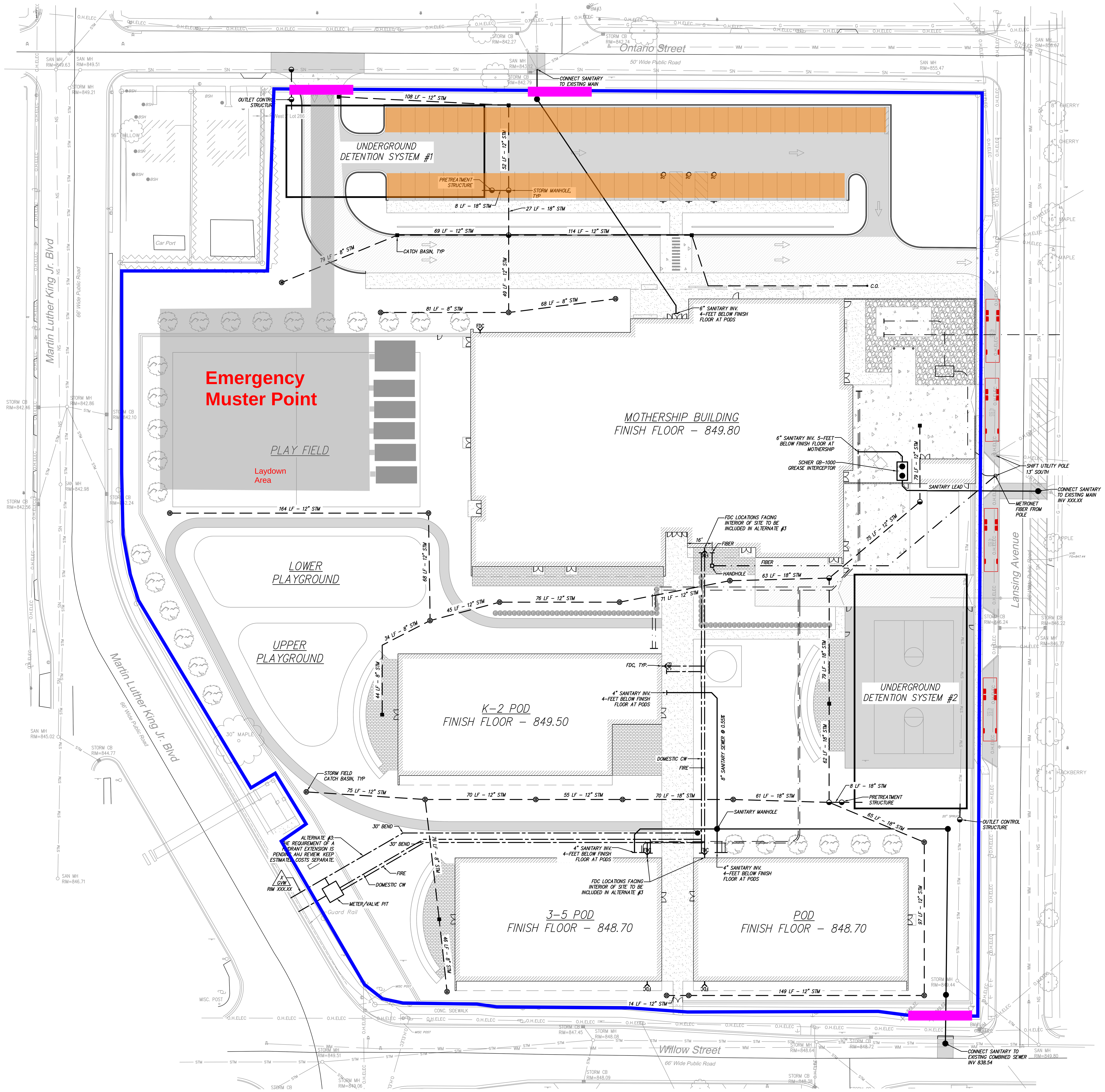
On-Site Contact(s):	Austin Brown, Project Engineer	(517) 505-9401
	Andrew Dobbs, Project Manager	(517) 230-5953
Off-Site Contact(s):		
	John Holmstrom, Senior Vice President	(517) 712-2042
	Don Staley, Vice President/Safety Director	(517) 819-9166

Lansing School District

On-Site Contact(s):	Marc Alexa, Plante Moran	(616) 258-0418

Date: May 8, 2014

Emergency Logistics Plan



GRAPHIC SCALE
0 15 30 60
(IN FEET)
1 inch = 30 ft.

LEGEND

PROPOSED WATERMAIN	PROPOSED SAN MANHOLE (SAN)
PROPOSED SANITARY	PROPOSED STORM MANHOLE (MH)
PROPOSED STORM SEWER	PROPOSED CATCH BASIN (CB)
PROPOSED GAS MAIN	PROPOSED INLET (INL)
PROPOSED ELECTRIC	PROPOSED END SECTION (ES)
PROPOSED HYDRANT	PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
PROPOSED GATE VALVE & WELL (GVW)	
PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)	
STANDARD BITUMINOUS PAVEMENT	UTILITY CROSSING (SEE DATA TABLE)
HEAVY-DUTY BITUMINOUS PAVEMENT	STORM SEWER STRUCTURE: STRUCT. TYPE / STRUCT. NO.
DEEP-STRENGTH BITUMINOUS PAVEMENT	SANITARY SEWER STRUCTURE
CONCRETE PAVEMENT	
CONCRETE SIDEWALK	WATERMAIN STRUCTURE: STRUCT. NO. / STRUCT. TYPE
MILL PAVEMENT	

UTILITY NOTES

1. STORM SEWER 12" AND LARGER SHALL BE C76 CL IV (PREM.JT.) UNLESS OTHERWISE NOTED ON THE PLAN.
2. STORM SEWER 6" AND SMALLER SHALL BE PVC SDR 23.5. STORM SEWER GREATER THAN 6" THROUGH 10" SHALL BE PVC SDR 26. WHERE STORM SEWER 12" AND LARGER IS NOTED AS PVC, PIPE SHALL BE SCHEDULE 40 PVC.
3. WHERE NOTED AS HDPE, STORM SEWER SHALL BE HDPE SMOOTH INTERIOR CORRUGATED PIPE MEETING AASHTO STANDARD M294M-98, UNLESS OTHERWISE NOTED ON PLAN. INSTALLATION SHALL ADHERE TO ASTM D2321 SPECIFICATION. AFTER INSTALLATION, PIPE SHALL BE CHECKED FOR DEFLECTION BY A METHOD APPROVED BY THE PIPE MANUFACTURER. ANY PIPE DEFLECTION EXCEEDING THE ALLOWABLE MAXIMUM MUST BE REMOVED AND REPLACED.
4. SANITARY SEWER 8" AND LARGER SHALL BE PVC TRUSS PIPE. LEADS 6" AND SMALLER SHALL BE SOLID WALL, PVC, SDR 23.5.
5. WATER MAIN SHALL BE CLASS 54 DUCTILE IRON. WATER MAINS SHALL BE LEAKAGE AND PRESSURE TESTED IN ACCORDANCE WITH AWWA STANDARD C600. WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD C651 PRIOR TO BEING PUT INTO SERVICE.
6. ALL UTILITY TRENCHES THAT FALL WITHIN A 1-ON-1 INFLUENCE OF PAVEMENT AREAS SHALL BE BACKFILLED WITH CLASS 2 SAND AND COMPACTED TO 95% OF MAXIMUM DENSITY.
7. ALL WATER MAIN SHALL BE BURIED WITH 5' OF COVER FROM PROPOSED GRADES. USE 22.5° BENDS TO LOWER WATER MAIN AS NECESSARY AND/OR WHERE NOTED AT UTILITY CROSSING.
8. ALL PUBLIC UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE CITY OF ALLEN PARK AND/OR WAYNE COUNTY.
9. ALL UTILITIES SHALL BE INSTALLED ON CLASS "B" BEDDING OR BETTER.
10. STORM SEWER STRUCTURE DIAMETERS SHALL BE AS NOTED ON THE PLANS. UNLESS OTHERWISE INDICATED, CASTINGS SHALL BE:
PVMT. CATCH BASINS – EJIW 5105 – "M1" (FRAMES WITH CURB BOXES WILL NOT BE ALLOWED)
FIELD CATCH BASINS – EJIW 1040 – "02"
STORM MANHOLES – EJIW 1040 – "A"
11. SANITARY MANHOLE COVERS SHALL BE LABELED "SANITARY SEWER" ONLY FOR PRIVATE STRUCTURES. REFER TO CITY STANDARDS FOR REQUIRED TEXT OF UTILITY CASTINGS AT PUBLIC STRUCTURES.
12. LOCATIONS OF LIGHT POLES, IF SHOWN ON THESE DRAWINGS, MAY BE APPROXIMATE. CONFIRM EXACT LOCATION (I.E. CURB OFFSETS, SIDEWALK OFFSETS, ETC.) PRIOR TO STAKING AND CONSTRUCTION. REFER TO SITE ELECTRICAL PLAN FOR DETAILS, AND COORDINATE WITH ELECTRICAL ENGINEER, ARCHITECT, AND CIVIL ENGINEER TO DETERMINE PROPER PLACEMENT.
13. WHERE PUBLIC UTILITY WORK SHOWN ON THESE PLANS DIFFERS FROM THE STANDARD DETAILS OR STANDARD SPECIFICATIONS OF THE COMMUNITY, THE COMMUNITY REQUIREMENTS SHALL GOVERN.

RIM ADJUSTMENT NOTE

REMOVE EXISTING CASTING, COVER AND ADJUSTMENT MATERIALS FROM STRUCTURE. SALVAGE CASTING AND COVER FOR REINSTALLATION AND PROVIDE NEW ADJUSTMENT BRICK/BLOCK/RINGS. REINSTALL ACCORDING TO STANDARD DETAILS (IF INCLUDED). PROTECT EXISTING UTILITY STRUCTURE TO REMAIN.

UNDERGROUND DETENTION INFORMATION

SYSTEM #1:
22,000 CU. FT. – 119 CHAMBERS

SYSTEM #2:
14,000 CU. FT. – 75 CHAMBERS

SPECIFICATIONS

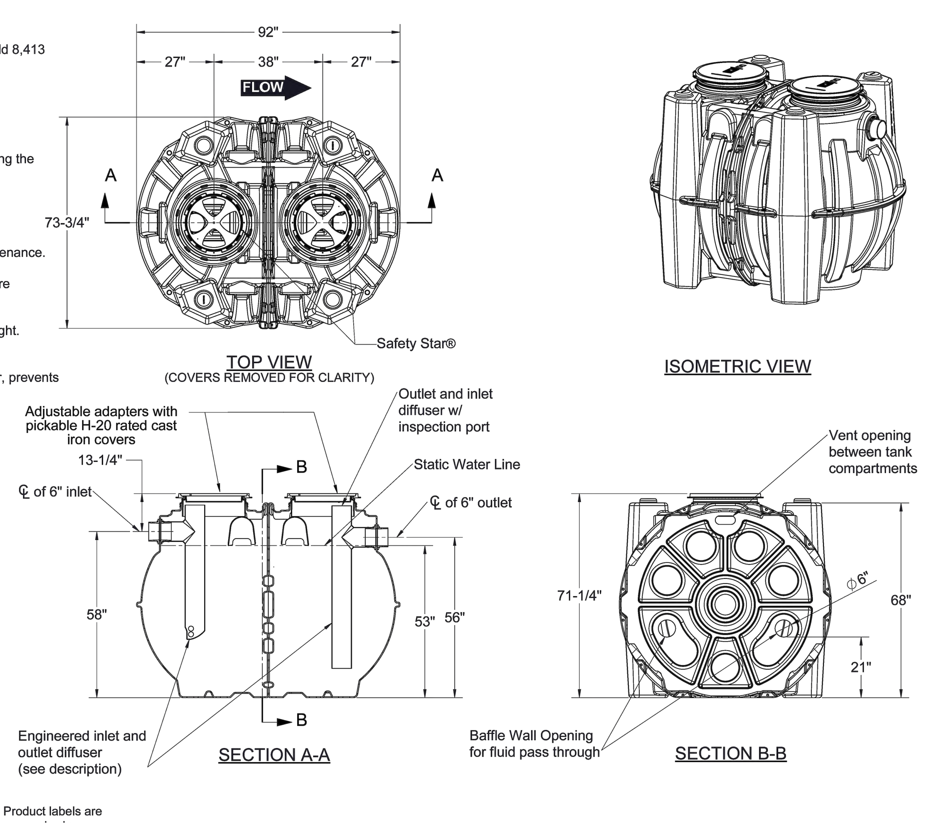
Notes:
1. 6" plain end inlet/outlet
2. Unit weight - w/ cast iron covers: 824 lbs. (for wet weight add 8,413 lbs.)
3. Maximum operating temperature: 150° F continuous
4. Capacities - Liquid: 1,000 gal.;
Grease: 5,495 lbs. (753 gal.) @100GPM
Grease: 4,959 lbs (679 gal.) @200GPM
Solids: 211 gal.
5. Satisfies Miami DERM 99% efficiency requirements; retaining the following capacities at 99.0% efficiency:
5,272 lbs. (722 gal.) @100GPM
3,127 lbs. (428 gal.) @200GPM
6. For gravity drainage applications only.
7. Do not use for pressure applications.
8. Cover placement allows full access to tank for proper maintenance.
9. Vent not required unless per local code.
10. Engineered inlet and outlet diffusers with inspection ports are removable to inspect / clean piping.
11. Integral air relief / Anti-siphon / Sampling access.
12. Adjustable cover adapters provide up to 4" of additional height.
13. Designed for below-grade, above-grade, indoor or outdoor installations.
14. Safety Star®, access restrictor built into each cover adapter, prevents accidental entry to tanks (450 lb rating).

ENGINEER SPECIFICATION GUIDE
Schier Great Basin™ grease interceptor model # GB-1000 shall be lifetime guaranteed and made in USA of seamless, molded polyethylene with minimum 7/16" uniform wall thickness. Interceptor shall be furnished for above or below-grade installation with adjustable cover adapter and Safety Star® access restrictor built into each cover adapter. Interceptor shall be certified to ASME A112.14.3 (Type D) and CSA B481.1 as well as certified to IAPMO/ANSI Z1001-2021. Interceptor flow rate shall be 100 GPM or 200GPM. Interceptor grease capacity shall be 5,495 lbs. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.

CERTIFIED PERFORMANCE
Great Basin™ hydromechanical grease interceptors are third party performance-tested and listed by IAPMO to ASME #A112.14.3 and CSA B481.1 grease interceptor standards and greatly exceed requirements for grease separation and storage. They are compliant to the Uniform Plumbing Code and the International Plumbing Code.

Type D certification does not require a flow control

MIAMI-DADE COUNTY — Satisfies Miami DERM 99% efficiency requirements. Product labels are permanently attached to inside and outside of unit for easy viewing.



SPECIFICATION SHEET

MODEL NUMBER:	PART NUMBER: 4080-002-01
GB-1000	DESCRIPTION: GB-1000 GREASE INTERCEPTOR 100 GPM/ 200 GPM 6" INLET/OUTLET, H-20 RATED CAST IRON COVER
PROPRIETARY AND CONFIDENTIAL	DWG BY: B.BROWN / DATE: 10/18/2021 / REV: 02 / ECO: 032822TA

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI
48915

Lansing School District

ISSUANCES	DATE
PROGRESS SET	07.26.2023
DEMOLITION SET	07.28.2023
DESIGN DEVELOPMENT SET	08.17.2023

KEY PLAN
N

JOB NO. 2616.01A
SHEET TITLE
UTILITY PLAN
SHEET NO.
C6.1

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01010 SUMMARY OF WORK

01011 RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this section.

1.2 Information given in the Division 1 General Requirements shall supplement information given in the General and Supplementary Conditions. The most stringent provision in the General Conditions, General Requirements, Contract Drawings and Specifications shall govern the execution of any work or requirement.

01012 CONSTRUCTION MANAGER

1.1 The Christman Company is the Construction Manager. Wherever the term General Contractor or Contractor (in the context of the General Contractor) is used, it shall be given the same meaning as Construction Manager.

1.2 The Trade Contractor and his sub-Trade Contractors shall agree to and accept the same responsibility and follow the same terms of the Conditions of the Contract as the Construction Manager for the work for which he is under contract.

01013 PROJECT

1.1 The Work as defined in the General Conditions and described in the Contract Document.

01014 RELATED WORK NOT-IN-CONTRACT (NIC)

1.1 Reference Section 00210 for any work that will be performed by the Owner or accomplished under separate contract.

01015 REPLACEMENT MATERIAL (For Owner's future use)

1.1 If any specific amounts are called for in the individual Sections, provide the specified amounts. If none are specified and a surplus is left, request instructions from the Construction Manager before discarding the surplus.

01016 LABOR, MATERIALS, TAXES & WORKMANSHIP

1. LABOR AND MATERIALS

1.1 Unless otherwise specified in these Contract Documents, all materials and workmanship shall be new and of the best grade of their respective kind for the purpose.

1.2 Unless otherwise specifically provided in the Contract Documents, the Trade Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

1.3 The Trade Contractor shall at all times enforce strict discipline and good order among his

employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him.

2. TAXES

2.1 Unless tax exempt status is specifically noted, it is understood that the bid prices stated shall include all applicable Federal, State or other Governmental division taxes and assessments. Also, all contributions for unemployment compensation, health and welfare, old age benefits or other purposes now or hereafter effective during the term of the contract, and the Owner and Construction Manager shall not be liable for any additional charges therefore.

01017 CRITICAL PHASING & STAGES OF CONSTRUCTION

1. INTRODUCTION

1.1 Critical phasing and critical stages of construction have been established herein for the project. It is extremely important that the "Critical Phasing & Stages of Construction" requirements be understood and complied with.

1.2 The Construction Manager shall coordinate detailed critical phasing and sequencing and scheduling with the Owner's representative.

1.3 The Construction Manager shall provide overall scheduling and coordination for the entire project. All Trade Contractors shall acknowledge the Construction Manager's right to establish and set up, or subsequently modify, the sequencing and scheduling of all Work on this project for the earliest completion and/or benefit to the Owner.

1.4 All Trade Contractors shall expedite the ordering and delivering of materials and equipment, etc. to meet these critical phasing and staging requirements and to make every effort possible to minimize disruption of normal building usage.

2. BID SCHEDULES

2.1 The preliminary construction schedule narrative included in the Contract Documents represents the general order and time frames for work to be followed by the Construction Manager in coordinating the project. Trade Contractors are to assume that their work will be coordinated in a manner consistent with industry practice, and the efficient coordination of all other trades. Trade Contractors recognize and accept their work may be sequenced and paced by other trades.

2.2 Please note that although the schedule defines the planned order of construction, Bidders should not assume that any assurance is given or implied as to the calendar dates associated with completion of the work of a particular contract.

2.3 All Trade Contractors and Trade Subcontractors recognize and shall accept modifications to the schedule which are reasonable, in the opinion of the Construction Manager, for the general interest of the project as a result of allowable time extensions (formally or informally approved) in any contract, and such modifications are inherent to the construction process and shall not qualify as a basis for extra compensation from the Construction Manager or Owner.

2.4 The Trade Contractor, in submitting a proposal for the work of a particular work category, agrees to commit the necessary resources to complete the work activities of that work category, within a time span not greater than the planned duration. Work included within a work category, but not specifically defined by a particular work activity, is to be accomplished in a reasonable manner in conjunction with other work of the work category, and in such a way as to avoid complication of or to delay the work of other Trade Contractors.

3. PROJECT SEQUENCING

3.1 GENERAL SEQUENCING

3.1.1 The overall project sequencing is indicated within the Preliminary Construction Schedule. Refer to Section 00200 and Section 01310.

3.2 RESTRICTIVE SEQUENCING & SCHEDULING

3.2.1 More restrictive sequencing to coordinate the Owner's on-going operations and/or for the coordination of the various trades shall be identified in Section 00210 SPECIAL PROVISIONS or as otherwise directed by the Construction Manager; All Trade Contractors agree to cooperate and alter their operations to maintain these more specified restrictions and sequences of the work.

3.3 SPECIFIC PROJECT REQUIREMENTS

3.3.1. Refer to the work category description and Section 00210 for specific information on scheduling requirements.

4. MUTUAL COOPERATION

4.1. Mutual cooperation between the Owner, the Architect, the Construction Manager, and the Trade Contractors to coordinate these construction and building operation requirements is anticipated and expected.

01018 USE OF SITE

1.1 Trade Contractor shall limit his use of the premises for his work and for storage to allow for (I) work by other Trade Contractors; (ii) Owner occupancy; and (iii) public use.

1.2 Limitations on site usage as well as specified requirements that impact site utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, the Construction Manager will administer allocation of available space equitably among entities needing both access and space so as to produce the best overall efficiency in performance as the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

1.3 ACCESS TO SITE

Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.4 Trade Contractor shall assume full responsibility for the protection and safekeeping of products under his contract, stored on the site.

1.5 Move any stored products, under Trade Contractor's control, which interfere with operations of the Owner or separate Contractor.

1.6 Obtain and pay for the use of additional storage or work areas needed for operations.

1.7 Nonsmoking Requirement: The use of any tobacco products, including cigarettes, vaping, chew, or otherwise is strictly prohibited on the project site per state and local laws given the nature of the project being a K-12 School. No smoking is allowed on this project.

01019 OWNER'S RIGHT TO OCCUPY

1.1 The Owner, at his election, may from time to time occupy any parts of the project as the work in connection therewith is completed to such a degree as will, in the opinion of the Owner, permit of their use for the purposes for which they are intended. The Owner will, prior to any such partial occupancy, give notice to the Construction Manager thereof and such occupancy shall be based upon the following:

a. Such occupancy shall not constitute an acceptance of work not performed in accordance with the Contract Documents or relieve Trade Contractors of liability to perform any work required by their Contract but not completed at the time of occupancy.

b. Trade Contractors shall be relieved of all maintenance costs on the units or parts occupied under this agreement.

c. Owner shall assume the risk of loss with respect to any unit or part occupied under the terms of this agreement.

d. The Trade Contractor shall not be required to furnish heat, light and water or other such services used in the units or parts occupied, without proper re-numeration therefore.

END OF SECTION

01019 CONTRACT CONSIDERATIONS

SECTION INCLUDES:

1.1 Inspection and Testing Allowance

1.2 Schedule of Values

1.3 Application for Payment

1.4 Change Procedures

1.1 INSPECTION & TESTING ALLOWANCES

If inspection and testing allowances have been assigned to the Trade Contractors, the following shall apply:

1.1.1 Costs included in allowances

a. Cost of engaging an inspection or testing firm, execution of inspection or tests, reporting results.

1.1.2 Costs not included in the allowance:

a. Incidental labor and facilities required to assist inspection or testing firm.

b. Costs of testing laboratory services required by Contractor separate from Contract Document requirements.

c. Costs of retesting upon failure of previous tests as determined by Architect-Engineer.

1.1.3 Payment Procedures:

a. Submit one copy of the inspection or testing firm's invoice with next application for payment.

b. Pay invoice on approval by Architect-Engineer.

1.1.4 Funds will be drawn from inspection and testing allowances only by Change Order.

1.2 SCHEDULE OF VALUES

1.2.1 Submit schedule through Contractor's Trade Contractor Portal. Application for Payments cannot be processed until Schedule of Values is approved. Without prior approval of the Construction Manager, **no single line item can exceed $150,000. Unless indicated otherwise, allowances and change orders must be listed as separate line items.**

The schedule of values must be itemized as follows:

1.2.2 Format: Unless instructed otherwise, utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify bonds, insurance, and permits separately.

1.2.3 Allowances should be added as individual line items for each section in the Schedule of Values.

1.2.4 Include within each line item, a directly proportional amount of Contractor's overhead and profit.

1.2.5 Approved Change Orders will automatically be added as a line item in the Schedule of

Values through the Trade Contractor Portal.

1.3 APPLICATIONS FOR PAYMENT

1.3.1 Pay Applications are to be created and submitted through the Trade Contractor Portal which conforms to the AIA G702 Form. The Trade Contractor Portal is the exclusive method of submitting a payment application.

1.3.2 Payment Period: First of month to first of month unless agreed to otherwise.

1.3.3 Waiver of liens and Sworn Statements shall accompany all Payment Requests unless agreed to otherwise. Also to be produced and submitted through the Trade Contractor Portal.

1.4 CHANGE PROCEDURES

1.4.1 The Architect-Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 1987 Edition, Paragraph 7.4.

1.4.2 The Architect-Engineer may issue a change management document which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within five (5) calendar days.

1.4.3 The Contractor may propose a change by submitting request for change to the Architect-Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Sections 01600 and 01600A.

1.4.4 Stipulated Sum/Price Change Order: Based on change management document and Contractor's fixed price quotation; or, Contractor's request for a Change Order as approved by Architect-Engineer.

1.4.5 Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a change management document. Changes in Contract sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

1.4.6 Change Management Document: Architect-Engineer may issue a change authorization signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

1.4.7 Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Architect-Engineer will determine the change allowable in Contract Sum/Price and Contract Time as provided in the Contract Documents.

a. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate

costs for changes in the Work.

b. Execution of Change Orders: Architect-Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

c. Overhead and Profit: Overhead and Profit shall include the following:

d. Supervision, Superintendents, Commercial General Liability and Umbrella Insurances, Wage of Time Keepers, Watchmen and Clerks, Small tools with material value of less than $1,500.00, Incidentals, General Office Expense, and all other expenses not included in Labor Rates. The percentage fee for Overhead and Profit on the Contractor's own work shall be 15% of net cost. The percentage fee for Overhead and Profit on Subcontractor's work shall be 5%.

END OF SECTION

01020 ALLOWANCES

1. GENERAL

1.1 Allowances will be established as directed in the Work Category Descriptions and are required to be included within the Trade Contractor's base bid. The amount included is an actual cost and does not include overhead and profit. Overhead and profit shall be included in the Trade Contractor's base bid, not in the allowance. Charges against the allowances will be at the Trade Contractor's net rate without overhead and profit as it is already included in the Contractor's base bid. These allowances are set up to be used only when authorized by the Construction Manager. Labor charged against the allowances will be in accordance with mutually accepted labor rates listed in each Trade Contractor's respective contract. Work expended by use of the allowances may be billed for each month in the Trade Contractor's monthly billing provided proper documentation and allowance authorizations are provided. In the event a balance remains within a specific allowance at the end of the project, a change order will be issued deducting the balance remaining in the allowance from the Trade Contractor's contract. All savings as a result of the Trade Contractor's non-use of these allowances will be the Owner's.

END OF SECTION

01030 SPECIAL PROJECT PROCEDURES

01031 ALTERATIONS

1.3 GENERAL REQUIREMENTS

1.3.1 All Federal, State and local laws, rules, regulations and ordinances for asbestos related work shall be adhered to, including but not limited to, OSHA, MIOSHA, EPA and DEQ.

1.3.2 All Non-Abatement Trade Contractors working around asbestos containing materials are to have a minimum of 2-hours of awareness training on the health and safety aspects of asbestos.

1.3.3 All Non-Abatement Trade Contractors involved with the disturbance of Category I non-friable asbestos (roof felts, floor tile, transit chimney, etc.) are required to have all workers receive a minimum of 8-hours "hands-on" OSHA approved training prior to beginning work.

1.3.4 In addition a Non-Abatement Trade Contractor involved with the removal of Category I non-friable asbestos will have at least one on-site worker, employed by the Non-Abatement Trade Contractor, who has successfully completed an asbestos "Supervisor" course and received accreditation. The course shall meet the criteria of EPA's Model Accreditation Plan (40CFR Part 763) for Supervisor or its equivalent.

1.3.5 Documentation of said training must be posted at the job site during the removal of asbestos containing material(s), disposal, and/or handling.

1.3.6 Monitoring will be conducted pursuant to OSHA regulation 29 CFR 1926.1101.

1.3.7 **THE NON-ABATEMENT TRADE CONTRACTOR IS TO STOP WORK AND NOTIFY THE CONSTRUCTION MANAGER ANY TIME SUSPECTED ASBESTOS CONTAINING MATERIALS ARE ENCOUNTERED BY ANY OF HIS/HER WORKERS.**

1.3.8 All Non-Abatement Trade Contractors that will be removing Category I non-friable asbestos containing materials are to contact the Owner who will arrange and pay for the Environmental Consultant to provide air monitoring services.

1.4 EXCLUSIONARY STATEMENT FOR BUILDING CONSTRUCTION/RENOVATION MATERIALS

1.4.1 All building materials/products used for renovations or replacement purposes are to be asbestos and lead-free. Asbestos and lead-free is to be defined as materials that contain 0% asbestos or lead. All Contractors are to be prepared to submit data, for a building material/product that he/she is proposing or required to use, to verify the absence of asbestos and lead.

1.4.2 The Non-Abatement Trade Contractors are to complete and sign the form titled "Exclusionary Statement for Building Construction/Renovation Materials".

1.5 NOTIFICATION

1.5.1 All Non-Abatement Trade Contractors that are required to remove Category I non-friable asbestos are to fill out and submit to the Michigan Department of Natural

Resources, the "**NOTIFICATION OF INTENT TO RENOVATE/DEMOLISH**", in accordance with the Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) and the Department of Labor and Economic Growth (DLEG).

END OF SECTION

01040 COORDINATION

01041 GENERAL

1.1 The Construction Manager is ultimately responsible for coordination to complete all work shown on the drawings and specified herein independent of the location of the work on drawings and within the specifications. The arrangement of work within the specifications into Divisions and Sections shall be considered as given for convenience of reference only and shall not be held to conform to jurisdictional rules which may prevail in any particular trade. It shall be the responsibility of the Construction Manager to so arrange or group items of work under a particular trade to conform with the prevailing customs of that trade and best interest of the Owner.

01042 GENERAL INSTALLATION PROVISIONS

1.1 PRE-INSTALLATION CONFERENCES: The Construction Manager shall hold pre-installation meeting at the project site well before installation of each unit of work, which requires coordination with other work. Installer and representatives of the manufacturers and fabricators who are involved in or affected by that unit of work, and with its coordination or interpretation with other work that has preceded or will follow shall attend this meeting. The Construction Manager will advise the Architect/Engineer of scheduled meeting dates.

a. The Construction Manager shall record significant discussions of each conference, and record agreements and disagreements, along with the final plan of action. The Construction Manager shall then distribute the record of meeting promptly to everyone concerned, including the Owner and Architect/Engineer.

b. Do not proceed with the work if the pre-installation conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the work and reconvene pre-installation conference at the earliest possible date.

1.2 Installer's Inspection of Conditions: Require the installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The installer shall report all unsatisfactory conditions in writing to the Construction Manager. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

1.3 Coordinate enclosure of the work with required inspections and tests so as to minimize the necessity of uncovering work for that purpose.

1.4 Mounting Heights: Where mounting heights are not indicated. Refer to the Construction Manager for decision. Products installed at a location not indicated or approved by the Architect or Construction Manager shall be relocated at the Trade Contractor's expense.

01043 COORDINATION OF PERMANENT UTILITY CONNECTIONS

1.1 New utility connections shall be coordinated with local utilities and the Project Superintendent.

01044 MECHANICAL & ELECTRICAL COORDINATION

1.1 All Trade Contractors shall make arrangements with the Construction Manager before connecting to existing facilities. If interruption of service is required, it shall be done at the convenience of the Owner as scheduled by the Construction Manager / General Contractor.

END OF SECTION

01045 CUTTING AND PATCHING

1. GENERAL

1.1 RELATED DOCUMENTS

Drawing and general provisions of contract, including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this Section.

1.2 DESCRIPTION OF REQUIREMENTS

1.2.1 Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

a. "Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.

1.3 RELATED WORK SPECIFIED ELSEWHERE

1.3.1 Refer to mechanical and electrical specifications sections for additional requirements and limitations on cutting and patching of mechanical and electrical work.

1.4 QUALITY ASSURANCE

1.4.1 Requirements for Structural Work: Do not cut and patch structural work in a manner that would result in a reduction of load-carrying capacity or of load-deflection ratio.

a. Before cutting and patching the following categories of work, obtain the Construction Manager's approval to proceed:

- Structural Steel - Miscellaneous structural metals, including lintels, equipment supports, stair systems and similar categories of work.
- Structural Concrete - Foundation construction, Retaining walls, Structural decking, Exterior wall construction, Piping, ductwork, vessels and equipment. Reinforcing steel shall not be heated to bend or reshape a bar.

b. Visual Requirements: Do not cut and patch work exposed on the building's exterior or in it's occupied spaces, in a manner that would, in the Architect/Engineer's opinion, result in lessening the building's aesthetic qualities. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work. Remove and replace work judged by the Architect/ Engineer to be cut and patched in a visually unsatisfactory manner.

2. PRODUCTS

2.1 MATERIALS

2.1.1 General: Use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials for cutting and patching that will result in equal-or-better performance characteristics.

3. EXECUTION

3.1 INSPECTION

3.1.1 Inspect existing conditions of the project, including elements subject to damage or to movement during cutting and patching.

3.1.2 After uncovering work, inspect the conditions affecting the installation of products or performance of the work.

3.1.3 Report unsatisfactory or questionable conditions to the Construction Manager in writing; do not proceed with the work until the Construction Manager has provided further instructions.

3.2 PREPARATION

3.2.1 Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.

3.2.2 Provide devices and methods to protect other portions of the project from damage.

3.2.3 Provide protection from the elements for that portion of the project, which may be exposed by cutting and patching work, and maintain excavations free from water.

3.3 PERFORMANCE

3.3.1 Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation or repairs. Cutting and patching shall be performed by individuals certified, licensed, or otherwise qualified as experienced and with sufficient training to perform the required task.

3.3.2 Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

3.3.3 Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.3.4 Restore work which has been cut or removed; install new products to provide complete work in accord with requirements of Contract Documents.

3.3.5 Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

3.3.6 Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

3.3.7 For continuous surfaces refinish to nearest intersection. For an assembly, refinish the entire unit.

3.4 CLEANING

3.4.1 Thoroughly clean areas and spaces where work is performed or used as access to work. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

4. CUTTING & PATCHING FOR MECHANICAL WORK

4.1 The Mechanical Contractor shall be responsible for all cutting, core drilling, and patching for their work. Cutting and patching shall be performed by individuals certified, licensed, or otherwise qualified as experienced and with sufficient training to perform the required task.

4.2 The Mechanical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the mechanical work. Any additional openings required to move his work due to an error in the initial layout shall be made at the expense of the Mechanical Contractor.

5. CUTTING & PATCHING FOR ELECTRICAL WORK

5.1 The Electrical Contractor shall be responsible for all cutting, core drilling, and patching for their work. Cutting and patching shall be performed by individuals certified, licensed, or otherwise qualified as experienced and with sufficient training to perform the required task.

5.2 The Electrical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the electrical work. Any additional openings required to move his work due to an error in the initial layout shall be made at the expense of the Electrical Contractor.

END OF SECTION

TECHNICAL SPECIFICATIONS

FOR

WILLOW ELEMENTARY SCHOOL
BUILDING AND SITE DEMOLITION
LANSING SCHOOL DISTRICT
LANSING, MICHIGAN

JULY 28, 2023

A/E NO. 2616-01A

OWNER
LANSING SCHOOL DISTRICT
519 WEST KALAMAZOO STREET
LANSING, MICHIGAN 48933
(517) 755-1000

ARCHITECTS/ENGINEERS
KINGSCOTT ASSOCIATES, INC
259 EAST MICHIGAN AVENUE, SUITE 308
KALAMAZOO, MICHIGAN 49007
(269) 381-4880

CONSTRUCTION MANAGER
THE CHRISTMAN COMPANY
208 NORTH CAPITOL AVENUE
LANSING, MICHIGAN 48604
(517) 482-1488

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TECHNICAL SPECIFICATIONS

FOR

WILLOW SCHOOL
LANSING SCHOOL DISTRICT
LANSING, MICHIGAN

JANUARY 26, 2024

A/E NO. 2616-01A

OWNER
LANSING SCHOOL DISTRICT
519 WEST KALAMAZOO STREET
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DIVISION 33 – UTILITIES
331100 WATER MAIN
333100 SITE SANITARY SEWERS
334100 STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES
334605 SUBDRAINAGE SYSTEMS - PEASTONE

SECTION 003132
GEOTECHNICAL INFORMATION

PART 1 – GENERAL

1.1 GEOTECHNICAL REPORT

A. An investigation of the site in the vicinity of the building was made for the limited purpose of establishing design parameters to be used by the Architect. Test pit logs and test boring logs from this report are bound into this Project Manual for Bidder's Information.

1.2 INTERPRETATION OF GEOTECHNICAL INFORMATION

A. Although bidders are encouraged to study this information, the Owner does not present the information to the Contractor as either a fully accurate or a comprehensive indication of subsurface conditions. Bidders are invited to make additional investigations at their own expense.

B. No claim for extra cost or extension of time resulting from a reliance by the Contractor on information presented in a geotechnical report, boring log, or soil testing log, shall be allowed, except as provided in the General Conditions.

SECTION CONTINUES WITH GEOTECHNICAL DATA

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GEOTECHNICAL EVALUATION REPORT

WILLOW K-8 SCHOOL
1012 WEST WILLOW STREET
LANSING, MICHIGAN

SME Project No. 092683.00
July 26, 2023

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2663 Eaton Rapids Road
Lansing, MI 48911-6310

T (517) 887-9181

www.sme-usa.com

July 26, 2023

Lansing School District
c/o Mr. Marc A. Alexa
Vice President
Plante Moran Cresa
3000 Town Center, Suite 100
Southfield, Michigan 48075

Via E-mail: marc.alexa@plantemoran.com

RE: Geotechnical Evaluation
Willow K-8 School
1012 West Willow Street
Lansing, Michigan 48915
SME Project No. 092683.00

Dear Mr. Alexa:

We have completed our geotechnical evaluation for the Willow K-8 School project in Lansing, Michigan. This report presents the results of our observations and analyses, and our geotechnical engineering and pavement engineering recommendations based on the information disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Very truly yours,

SME

Bradford L. Ewart II, PE
Vice President / Senior Consultant

Enclosure: SME Geotechnical Evaluation Report; Dated July 26, 2023

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APPENDIX A

BORING LOCATION DIAGRAM (FIGURE NO. 1)
BORING LOG TERMINOLOGY
BORING LOGS (B1 THROUGH B12 AND P1 THROUGH P4)
USACE DCP DATA SHEETS (P1 THROUGH P4)

APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT
GENERAL COMMENTS
LABORATORY TESTING PROCEDURES

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1. INTRODUCTION

This report presents the results of the geotechnical evaluation performed by SME for the Willow K-8 School project in Lansing, Michigan. This evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P01140.23, dated March 29, 2023. In-situ infiltration testing was not performed due to subsurface conditions encountered. This evaluation was authorized by the Lansing School District.

To assist with our evaluation and the preparation of this report, SME was provided a PDF drawing with the filename “C1.1 General Plan Civil” prepared by Kingscott Associates, Inc. and provided to SME on May 3, 2023.

1.1 SITE CONDITIONS

The project site is located at the existing Willow Elementary School at 1012 West Willow Street in Lansing, Michigan. The location of the site is depicted on the Location Map inset on the Boring Location Diagram (Figure No. 1) included in Appendix A of this report.

The site currently consists of the existing school building, playgrounds, grass covered areas, a paved parking lot, and sidewalks. Based on our cursory review of historical images, the site appears to have been a school dating back to 1955. However, it appears a second building was formerly located on the southeast corner of the site and was demolished between 1956 and 1970. Based on the topographic information contained in the referenced drawing prepared by Kingscott Associates, Inc., the existing ground surface within the proposed development area ranges from approximate elevations 843 feet to 856 feet. The existing school building has a finished floor elevation (FFE) of approximately 850 feet.

1.2 PROJECT DESCRIPTION

We understand the project will consist of the demolition of the existing school building and the design and construction of a new school campus consisting of a main school building, three satellite buildings (“POD’s”), playground areas, and a drive and parking lot. The locations of the proposed site features are illustrated on Figure No. 1.

The buildings will be one- to two-story, slab-on-grade buildings containing classrooms, a lunchroom, gymnasium, and other school functions. The buildings will include steel framing with load bearing masonry walls. Based on our experience with similar types of projects, we anticipate structural loads will include maximum column loads of 100 kips and maximum wall loads of 4 kips per linear foot. However, specific structural loading information has not been provided to us at this time. We have not been provided FFEs for the proposed buildings. However, we assume the FFE of the main school building will match the FFE elevation of the existing building at about 850 feet. The FFE of the POD building could vary by a few feet. Based on our assumed FFEs and the existing site grades, fills of up to 4 feet will be required in the proposed building areas.

A hot mix asphalt (HMA) drive and parking lot will be constructed north of the proposed buildings and connecting to Lansing Avenue to the east and Ontario Street to the north. Within pavement areas, we anticipate cuts of as much as about 1 foot and fills of as much as about 3 feet will be required to establish final subgrade levels. The anticipated traffic loading will primarily consist of passenger vehicles. However, you have requested the pavements be designed to support school bus traffic in the event that traffic patterns change in the future.

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2. EVALUATION PROCEDURES

2.1 FIELD EXPLORATION

SME completed 12 building borings (B1 through B12) and 4 pavement borings (P1 through P4) between April 3 and April 7, 2023. Borings B1 through B12 extended to a depth of 25 feet below ground surface, and borings P1 through P4 extended to a depth of 10 feet below ground surface for a total of 340 feet of drilling. The approximate locations of the borings are depicted on Figure No. 1 in Appendix A.

SME determined the number, locations, and depths of the borings. SME staked the borings in the field and determined existing ground surface elevations using a hand-held GPS unit with sub-foot accuracy. However, the existing ground surface elevation at boring B2 was estimated using the referenced drawing.

Dynamic Cone Penetrometer (DCP) tests designed by the U.S. Army Corps of Engineers (USACE) were conducted adjacent to boring locations P1 through P4 to evaluate the consistency of the upper subgrade soils. USACE DCP testing is conducted to estimate the California Bearing Ratio (CBR) of the subgrade materials. The USACE DCP consists of a 5/8-inch-diameter steel rod with a steel cone attached to one end that is driven by means of a sliding dual mass hammer. The rate of cone penetration per blow is measured at selected penetration, or hammer drop, intervals. California Bearing Ratio (CBR) is an index commonly used in pavement design that provides an indication of subgrade support characteristics. The Corps of Engineers have developed relationships to estimate the CBR value from the results of the USACE DCP test. The results of the USACE DCP tests are included in Appendix A.

The borings were drilled using a truck-mounted rotary drill rig and were advanced using continuous-flight hollow-stem augers. The borings included soil sampling based upon the Split-Barrel Sampling procedure. The N_{60}-values reported on the boring logs represent the Standard Penetration Test (SPT) resistances, normalized for drill rig hammer efficiency, which is also reported on the boring logs. Recovered split-barrel samples were sealed in glass jars by the driller.

Groundwater level observations were recorded during and immediately after completion of each boring. The boreholes were backfilled with auger cuttings after completion and collection of groundwater readings. Therefore, long-term groundwater levels were not obtained from the borings. Borings performed in existing pavement areas were capped with similar materials. See the attached boring logs for the backfilling procedures.

Soil samples recovered from the field exploration were delivered to the SME laboratory for further observation and testing.

2.2 LABORATORY TESTING

The laboratory testing program consisted of performing visual soil classification on recovered soil samples in general accordance with ASTM D-2488. Moisture content and hand penetrometer tests were performed on portions of the recovered cohesive samples. The Laboratory Testing Procedures in Appendix B provides general descriptions of the laboratory tests. Based on the laboratory testing, we described the soils and assigned a Unified Soil Classification System (USCS) group symbol to each of the soil strata encountered.

Upon completion of the laboratory testing, boring logs were prepared that include information on materials encountered, the soil descriptions, penetration resistances, pertinent field observations made during the drilling operations, and the results of the laboratory testing. The boring logs are included in Appendix A. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples are normally retained in our laboratory for 60 days and are then disposed of, unless instructed otherwise.

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3. SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

3.1.1 BUILDING BORINGS

The soil conditions encountered at the building boring locations (B1 through B12) generally consisted of surficial material (topsoil or asphalt), underlain by natural clays, silts, and sands. However, existing fill was encountered in borings B1, B5, B7, B11, and B12. In addition, pavement nor discernable topsoil was encountered at borings B5, B7, and B11. The existing fill extended to depths ranging from about 1.4 to 3 feet below the existing ground surface, corresponding to elevations ranging from approximately 843 to 846.5 feet. The existing fill consisted of clay (borings B1, B5, B7, and B11) and sand (boring B12). The existing clay fill exhibited a medium to stiff consistency and had moisture contents that varied from 15 to 35 percent. The existing sand fill was encountered in a medium dense condition and contained asphalt fragments.

The natural sands were encountered in a very loose to very dense condition. The natural clay exhibited medium to hard consistencies and had moisture contents that varied from 10 to 35 percent. The natural non-cohesive silt was encountered in a medium dense condition, and the natural cohesive silts exhibited stiff to very stiff consistencies and had moisture contents that varied from 20 to 27 percent

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil, or organic layers. Therefore, the delineation of fill described above and on the boring logs should be considered approximate only.

Thickness measurements of surficial materials and depths of existing fill reported on the boring logs should be considered approximate since mixing of these materials with the underlying subgrade can occur in small-diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents or for quantity estimates, additional evaluations, such as shallow test pits in topsoil or fill areas and pavement cores in pavement areas, should be performed.

The soil profile described above and included on the boring logs is a generalized description of the conditions encountered. The stratification depths described above and shown on the boring logs are intended to indicate a zone of transition from one soil type to another. They are not intended to show exact depths of change from one soil type to another. The soil descriptions are based on visual classification of the soils encountered. Soil conditions may vary between or away from the boring locations. Please refer to the boring logs for the soil conditions at the specific boring locations.

3.1.2 PAVEMENT BORINGS

The soil conditions encountered at the pavement borings (P1 and P4) generally consisted of surficial topsoil (at boring B1) or pavement (at boring B4), underlain by existing fill, and underlain by natural clays and sands. However, existing fill was not encountered in boring P3 and boring P2 terminated in existing fill.

Existing clay fill extended to depths ranging from about 4 to 6 feet below the existing ground surface at borings P1 and P4, corresponding to elevations ranging from approximately 840.5 to 842.8 feet. Existing sand fill extending to the explored depth of boring P2 (10 feet). The existing clay fill exhibited a very stiff consistency and had moisture contents that varied from 14 to 18 percent. The existing sand fill was encountered in a loose to medium dense condition and contained asphalt fragments.

The natural sands were encountered in a very loose to medium dense condition. The natural clay exhibited medium to very stiff consistencies and had moisture contents that varied from 10 to 35 percent.

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It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil, or organic layers. Therefore, the delineation of fill described above and on the boring logs should be considered approximate only.

Thickness measurements of surficial materials and depths of existing fill reported on the boring logs should be considered approximate since mixing of these materials with the underlying subgrade can occur in small-diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents or for quantity estimates, additional evaluations, such as shallow test pits in topsoil or fill areas and pavement cores in pavement areas, should be performed.

The soil profile described above and included on the boring logs is a generalized description of the conditions encountered. The stratification depths described above and shown on the boring logs are intended to indicate a zone of transition from one soil type to another. They are not intended to show exact depths of change from one soil type to another. The soil descriptions are based on visual classification of the soils encountered. Soil conditions may vary between or away from the boring locations. Please refer to the boring logs for the soil conditions at the specific boring locations.

3.2 GROUNDWATER CONDITIONS

Groundwater was encountered in borings B1 through B12, P1, P3, and P4 during and upon completion of drilling at depths ranging from 1 to 17 feet below the ground surface, or approximate elevations ranging from 831 to 845 feet. Groundwater was not encountered during and/or upon completion of drilling at borings P2.

In clays and silts, a long time may be required for the groundwater level in the borehole to reach an equilibrium position. Therefore, the use of groundwater observation wells (piezometers) would be necessary to more accurately evaluate the hydrostatic groundwater level within the soils at this site.

Hydrostatic groundwater levels, perched groundwater conditions, and the potential rate of infiltration into excavations should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater levels indicated by the borings represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary from those conditions noted on the boring logs.

4. ANALYSIS AND RECOMMENDATIONS

4.1 SITE PREPARATION AND EARTHWORK

4.1.1 EXISTING FILL CONSIDERATIONS

Existing fill was encountered in the proposed building and pavement areas. We are not aware, nor have been provided with, records depicting the type of fill material, and if the fill was placed in suitable lifts and to a specified density under the observation of a geotechnical engineer. Therefore, the existing fill is considered undocumented and uncontrolled.

Based on the depths and variability of the existing fill, and the construction debris encountered in boring B12, we recommend the existing fill be removed below the entire proposed building footprints. However, based on the condition of the existing fill encountered in the borings, and the proposed type of construction, we believe the existing fill can remain below the pavements provided:

- The subgrade is properly evaluated by SME and prepared as described in Section 4.
- Unsuitable fill is undercut and replaced with engineered fill.
- The Owner accepts the associated risks described below.

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The increased risks associated with supporting pavements over the existing fill at this site could include greater than typical post-construction settlement, resulting in differential movements and associated cracking of the pavements. These risks can be reduced, but not eliminated, if SME further evaluates the existing fill at pavements subgrades. If the risks described above are not acceptable to the Owner, the existing fill should be completely removed from within the proposed pavements footprints and replaced with engineered fill.

If the existing fill will remain in-place for support of pavements, further evaluation of the existing fill during construction must be conducted by SME. Further evaluation should include observing the condition of the fill in hand-auger borings or shallow test pits, testing the fill using a dynamic cone penetrometer (DCP), observing the condition of the fill in the sides of the foundation excavations, and observing the response of the surface of the fill when subjected to a proofroll. Existing fill to remain in-place should be of sufficient strength and free of deleterious materials, such as excessive debris and organics. Unsuitable existing fill that cannot be improved in-place should be removed (i.e., undercut) and replaced with engineered fill that is placed and compacted per the requirements outlined in Section 4.1.4 of this report.

The recommendations provided in the following report sections are based on the assumption that existing fill will be removed below the proposed buildings, and suitable existing fill will remain in-place and be used to support the pavements. If the Owner does not accept the stated assumptions and risks, please contact SME for revised recommendations.

4.1.2 GENERAL SITE SUBGRADE PREPARATION

Existing utilities within the proposed building footprints should be rerouted around the proposed buildings. We recommend abandoned utilities be removed and the excavations backfilled with granular engineered fill to establish the design subgrade level.

The proposed buildings and pavement areas, and areas to receive engineered fill, should be cleared of existing foundations, below-grade walls, slabs, pavements, topsoil, vegetation, trees, tree roots, unsuitable fill, and other deleterious materials to expose suitable underlying inorganic subgrade, which is expected to consist of natural soils or suitable existing fill. Existing fill should be removed beneath the entire building footprints.

Since the exposed subgrade will consist of either sand or clay, depending on location, transition zones may be encountered. In areas where pavements will be placed on or near a sand/clay interface, differential settlement may occur due to the differing properties of the interface soils. To limit differential movement of the pavements in these areas, we recommend the upper 12 inches of the subgrade be scarified, blended, and recompacted to at least 95 percent of maximum Modified Proctor dry density a minimum or 10 feet on either side of the transition.

After clearing and stripping, transition areas are blended and properly prepared, and after cutting to design subgrade levels, but before placing fill to raise grades, SME should further evaluate the existing fill in proposed pavement areas. We recommend the exposed subgrade be proofrolled with a fully-loaded, tandem-axle dump truck or other pneumatic-tire construction equipment. The purpose of proofrolling is to locate areas of unsuitably loose or soft subgrade. Areas of unsuitable (i.e., wet, soft or loose) subgrade revealed during proofrolling should be mechanically improved (compacted) in-place or removed and replaced with engineered fill. Special attention during proofrolling should be directed to the response of the existing fill as a means to judge the suitability of the fill for support of pavements. Additional evaluation of the existing fill may include test pits and exploration with hand operated equipment, depending on SME's observations and the results of the proofroll.

Unsuitable existing fill in proposed pavement areas should be improved in-place or be removed (i.e., undercut) to expose suitable underlying subgrade soils. The undercuts to remove unsuitable fill should be backfilled with engineered fill meeting the requirements of Section 4.1.4 of this report.

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The subgrade soils that consist of silts, clays, and sands with more than about 15 percent fines (e.g. USCS Group Symbols of “CL” or “SC”) are sensitive to disturbance when exposed to water. If these subgrades are exposed to water, it may be necessary to improve the disturbed subgrade or remove and replace the soils with engineered fill, crushed aggregate or crushed concrete. Placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, is a traditional treatment to protect easily disturbed subgrades.

After the exposed subgrade is evaluated (as described above) and improved as necessary, engineered fill may be placed on the exposed subgrade to establish final design subgrade levels. See Section 4.1.4 of this report for materials and compaction requirements for engineered fill.

4.1.3 SUBGRADE PREPARATION FOR FLOOR SLABS

We recommend the existing fill be removed from the entire proposed building footprints. Therefore, the final floor slab subgrade for the proposed buildings will consist of natural clays or engineered fill overlying natural clays. These soils are considered suitable for support of floor slabs, provided the subgrade is prepared as described in Sections 4.1.2, and engineered fill is placed and compacted per Section 4.1.4. We recommend a subgrade modulus k (30) of 150 psi per inch be used to design floor slabs supported on properly prepared subgrade as described above. The recommend subgrade modulus k (30) is based on correlations with soil type developed from plate load tests conducted using a 30-inch diameter plate with 0.05-inches of deflection.

Prior to concrete placement for floor slabs, SME should observe and test the building pad subgrade to identify areas that were disturbed during construction activities and to verify the final subgrade conditions are suitable for floor slab support. Unsuitable subgrade identified by SME should be improved by compaction in place or removed and replaced with engineered fill. Final subgrade areas that are accessible with large equipment should be proofrolled, and areas inaccessible to proofrolling equipment should be evaluated with hand-operated equipment, such as cone penetrometers, hand auger probes, and density gauges.

The top 6 inches of the slab subbase should consist of an approved MDOT Class II granular material to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils. MDOT 21AA dense-graded aggregate can be used as subbase material, instead of the Class II granular material, for improved stability and greater resistance to disturbance due to construction traffic. The thickness of dense-graded aggregate required to stabilize and protect the subgrade will depend on the condition of subgrade soils during construction and the type and volume of construction equipment to traffic the prepared subgrade. The leveling surface must be compacted per the "Engineered Fill Requirements" section of this report as discussed in Section 4.1.4.

A vapor retarder should be provided below floor slabs that are to receive an impermeable floor finish/seal or a floor covering which would retard vapor transmission. The location of the vapor retarder (relative to the subbase) should be determined by the design Architect/Engineer based on the intended floor usage, planned finishes, and ACI recommendations.

We recommend separating slabs by isolation joints from structural walls and columns to permit relative movement. A minimum of 6 inches of engineered fill should be placed between the bottom of the slab and the top of the shallow foundation below, to allow for relative settlements.

The slab-on-grade subgrade soils should be protected from frost action during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

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4.1.4 ENGINEERED FILL REQUIREMENTS

Fill placed within structural areas, including utility trench backfill, should be an approved material, free of frozen soil, organics, debris, particle sizes that will hinder compaction, and other deleterious materials. Fill placed in structural areas should be compacted to a minimum of 95 percent of the maximum dry density determined in accordance with the Modified Proctor test. Fill should be spread in level layers with a loose thickness appropriate for the type of equipment used to obtain compaction. Sand fill should be compacted with a smooth-drum vibratory roller or vibratory plate compactors, including either walk-behind types or plate compactors mounted on a backhoe or excavator (i.e., a hoe-pac). Thinner lifts will be required in confined spaces and where compaction is achieved with hand-operated equipment. Clay fill should be compacted with sheepsfoot rollers at a moisture content between the optimum and two percent below the optimum.

Based on information from the borings, the site sands and clays encountered at the boring locations are considered suitable for reuse as site engineered fill, provided the material meets the requirements in the previous paragraph. We do not recommend silt be used as engineered fill. The successful reuse of clays and sands with more than about 15 percent fines (identified with USCS Group Symbols of “CL” or “SC”) for reuse as engineered fill will be dependent on the time of year. During cold and wet periods of the year, clays and sands with more than about 15 percent fines may become saturated and disturbed and difficult to dry. If such conditions occur, fill should be imported to the site and we recommend the fill material meet the requirements of MDOT Class II granular material.

In utility trenches or foundation excavations, and in other areas where compaction is accomplished primarily by smaller plate compaction equipment, an approved granular material containing relatively low amounts of silt or clay, such as MDOT Class II granular material, should be used as backfill. Thinner lift sizes may be required to achieve the required density in areas where smaller compaction equipment is used. MDOT Class II granular material should also be used in areas requiring drainage or where the fill will serve as a capillary break.

Coarse crushed aggregate used to backfill undercuts or to stabilize subgrades should consist of a well-graded, crushed natural aggregate or crushed concrete ranging from 1 to 3 inches in size with no more than 7 percent by weight passing the No. 200 sieve should be used. In cases where granular engineered fill will be placed over the crushed aggregate, the surface of the coarse crushed material should be choked with a layer of at least 6 inches of dense-graded aggregate, such as MDOT 21AA, or covered with a suitable non-woven geotextile, to mitigate the potential for migration of the granular materials into the coarser crushed aggregate.

4.2 FOUNDATIONS

4.2.1 SUBGRADE VERIFICATION

To verify the subgrade exposed at the foundation bearing surfaces is suitable for the recommended maximum net allowable soil bearing pressure, and to verify necessary improvements at or below the foundation subgrade have been performed properly, the final foundation subgrades must be evaluated and tested by SME during construction. By performing the geotechnical evaluation for this project, and preparing this geotechnical evaluation report, SME is the geotechnical engineer of record for this project and is best suited to verify the recommendations of this report, and the design requirements of this project, are in fact incorporated into the construction.

4.2.2 SHALLOW SPREAD FOUNDATIONS

We recommend supporting the proposed buildings on shallow spread foundations bearing on natural clays, or on engineered fill overlying suitable natural clays. Suitable clays were generally encountered below the surficial materials and existing fill soils, beginning about 1 to 3 feet beneath the existing ground surface, corresponding to approximate elevations 843 to 848 feet.

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We recommend a maximum net allowable soil bearing pressure of 2,000 pounds per square-foot (psf) for design of shallow foundations bearing on suitable soils described above at the anticipated proposed foundation subgrade elevation. The recommended design net allowable soil bearing pressure is based on a global safety factor of three or more (for general shear failure).

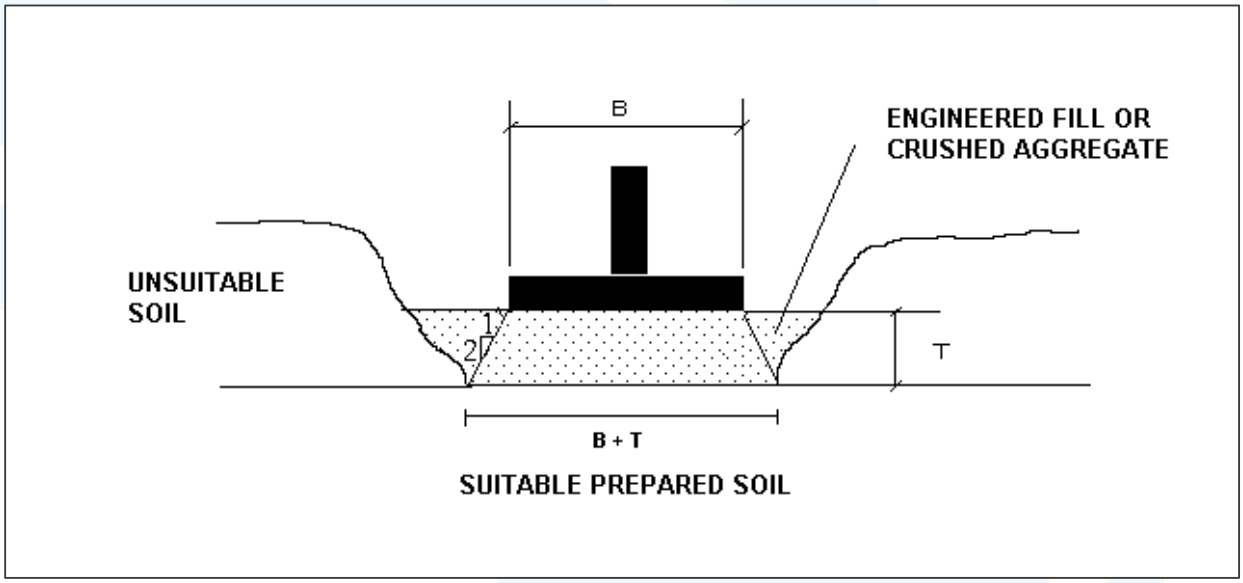
For bearing capacity and settlement considerations, we recommend continuous (wall) foundations have a minimum width of 18 inches and isolated (column) foundations have a minimum dimension of 30 inches. In cases where structural loading is light, the minimum recommended foundation size, and not the design bearing pressure, may govern the size of the foundation.

Foundations should be situated a minimum of 42 inches below final site grade in unheated areas for protection against frost action during normal winters. Interior foundations in heated areas of the building can be constructed at shallower levels on suitable soils just below the floor slab, provided they bear on suitable natural soils. The foundations and proposed bearing soils should be protected from freezing during construction if work occurs in the winter months.

We estimate total settlement for shallow spread or continuous foundations using the recommended maximum net allowable bearing pressure and bearing on suitable soils, as described above, should be 1 inch or less and differential settlements should not exceed about one-half the total settlement for similarly loaded foundations. We base the settlement estimates on the available boring information, the estimated structural loads, our experience with similar structures and soil conditions, and field verification of suitable bearing soils by SME.

4.2.3 FOUNDATION INSTALLATION

Once each foundation area is exposed, SME must observe and test the foundation subgrades to verify suitable bearing conditions are present. Existing fill should be removed beneath the entire building footprints. Overly soft clays or loose sands that are not suitable for the design bearing pressure encountered in foundation areas must be improved in-place or undercut to expose underlying suitable soils. If undercuts are performed, foundations can then be constructed to bear directly at the lower level where suitable subgrade is encountered, or the design foundation bearing level can be reestablished using engineered fill or crushed aggregate placed as backfill in the undercut excavation. Where backfilling to the design foundation bearing level is performed, the undercut excavation to remove unsuitable soils should extend laterally on a two vertical to one horizontal slope from the edge of the foundation. Please refer to the following Typical Foundation Undercutting Diagram.



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Footing excavations are expected to extend primarily through clays. Therefore, we anticipate conventional “neat-trench” methods of footing construction may be feasible. For frost heave considerations, vertical excavation sidewalls must be maintained during foundation concrete placement and the side walls must not be allowed to “mushroom out” near the top. If vertical earthen sidewalls cannot be maintained, it will be necessary to slope back the foundation excavations and form foundation sidewalls to maintain vertical faces for foundations and reduce the potentially adverse effects resulting from frost heave. Caved soils must be suitably removed from the foundation bearing surfaces before placing concrete.

The foundation subgrade soils at this site are susceptible to disturbance. To reduce the incidence and severity of subgrade disturbance, we recommend placing concrete as soon as possible (e.g., preferably the same day) after excavating for foundations. In cases where the excavation is required to remain exposed, the clayey subgrade can be protected and stabilized with a layer of 1- to 3-inch sized coarse crushed aggregate, as described in Section 4.1.4. Disturbed soils must be removed from foundation excavations and replaced with engineered fill, crushed aggregates, or concrete.

4.3 SEISMIC DESIGN PARAMETERS

Based on the subsurface information obtained from the borings to a maximum depth of 25 feet, seismic site Class D applies to this site in accordance with the 2015 MBC referencing Table 20.3-1 in ASCE Standard ASCE/SEI 7-10.

4.4 CONSTRUCTION CONSIDERATIONS

Groundwater seepage should be expected in shallow excavations due to the presence of interbedded sands and clays. However, we anticipate groundwater seepage into excavations that remain above about elevation 845 feet can generally be controlled using conventional sump pit and pumping techniques. In addition, accumulations from precipitation events, surface run-off, or perched groundwater sources could be encountered at elevations above about 845 feet, and standard sump pit and pumping procedures should be adequate to control these accumulations on a localized basis. Excavations extending below the groundwater levels in sands will require a high capacity dewatering system that is designed by a qualified professional engineer. A working surface of either crushed aggregate or crushed concrete may be required to protect the exposed subgrade where seepage is encountered.

The contractor must take precautions to protect nearby existing structures, roadways and utilities during construction. Care must be exercised during the excavating and compacting operations so that excessive vibrations do not cause settlement of the existing buildings, pavements and utilities.

The contractor should remove ponded surface water and prevent run-off from reaching foundation excavations and areas of prepared subgrade. We recommend the contractor establish positive surface drainage at the onset of construction to mitigate the potential for subgrade disturbance.

The need for moisture conditioning (i.e., aerating and drying) site clays, silts, and sands with more than 15 percent fines, and the success of moisture conditioning, will be dependent on the weather conditions at the time of construction. During cold and wet periods of the year, the site clays and sands with more than 15 percent fines may become saturated and disturbed and it may not be feasible to sufficiently dry the soils so that they are stable and can be adequately compacted. If these conditions occur, it will be necessary for the contractor to import greater quantities of clean granular fill (sand) to use as engineered fill on the site, and it would be necessary to export the site clays and sands with more than 15 percent fines if on-site disposal in non-structural areas is not feasible.

The contractor must provide safely sloped excavations or an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, use appropriate shoring to resist the extra pressure due to the superimposed loads.

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The contractor should remove ponded surface water and prevent run-off from reaching foundation excavations and areas of prepared subgrade. We recommend the contractor establish positive surface drainage at the onset of construction to mitigate the potential for subgrade disturbance.

Handling, transportation and disposal of excavated materials and groundwater should be performed in accordance with applicable regulatory requirements.

5. PAVEMENT DESIGN RECOMMENDATIONS

This section includes recommendations for design and construction of the proposed pavement areas described in Section 1.2. We have developed the following subgrade preparation and pavement design recommendations based on the borings, USACE DCP data, and previously discussed information in this report. As stated above, we anticipate cuts of as much as about 1 foot and fills of as much as about 3 feet will be required to establish final subgrade levels in the pavement areas. The proposed pavement layout is depicted in Figure No. 1.

5.1 TRAFFIC

We understand the pavement areas will be primarily trafficked by light-duty passenger vehicles; however, the access drive may be used as a bus loop in the future. In addition to bus traffic, we anticipate other heavy vehicle traffic including delivery trucks and garbage/recycling haulers will access the site.

Based on the anticipated traffic profile, and our experience with similar projects, we estimate approximately 50,000 Equivalent Single Axle Loads (ESALs) will occur over a 20-year period in the light-duty (vehicle parking) areas of the site. Should the access drive be used for bus loop traffic, we assumed up to 12 buses each day for a 200-day (40-week) school year for design purposes. Based on these traffic assumptions, we estimate approximately 250,000 Equivalent Single Axle Loads (ESALs) will occur over a 20-year period in the bus loop.

Should these traffic assumptions vary from the actual traffic loading conditions, SME should be provided the opportunity to review and revise the recommendations of this report.

5.2 PAVEMENT SUBGRADE PREPARATION

5.2.1 EXISTING SUBGRADE CONDITIONS AND SUPPORT

Based on the borings performed for this project near the anticipated pavement areas, and our understanding of the project, the subgrade within the proposed access drive areas is expected to consist of existing sand or clay fill or natural sand. Refer to the boring logs for additional information regarding subsurface conditions.

5.2.2 PAVEMENT SUBGRADE PREPARATION RECOMMENDATIONS

In general, the pavement subgrade should be prepared as described in Section 4.1.2. Subgrade preparation and aggregate base placement should extend out to at least 12 inches beyond the edge of the pavement to provide support for the outer edges of pavement. At haul roads and staging areas, we recommend subgrade preparation and aggregate base placement extend a sufficient lateral distance to allow truck turning actions without causing edge failures. In some cases, this may be wider than the design pavement section.

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Once compacted, the exposed subgrade should then be proofrolled with a fully loaded tandem axle truck in the presence of SME. Any overly yielding or loose areas (deflections of greater than 1/4-inch) should be stabilized by additional compaction and moisture conditioning or working a coarse crushed aggregate or crushed concrete material into the subgrade until a suitably stable surface is achieved. In some cases, it may be necessary to undercut unsuitable soils that cannot be mechanically stabilized in-place (i.e., by compaction and placement of coarse crushed aggregate), and to backfill the undercut excavations with the coarse crushed aggregate or another approved backfill material.

5.3 RECOMMENDED PAVEMENT SECTIONS

The pavement design recommendations presented herein are based on our experience with similar applications and AASHTO pavement design methodology. The design pavement section presented herein is anticipated to provide a useful service life of approximately 20 years if constructed and maintained properly. Maintenance activities including patching and crack sealing should be performed at periodic intervals to maintain the pavement surface and extend the serviceability. The HMA pavement section provided in Table 1 should be used in proposed access drives at the site.

TABLE 1: HMA PAVEMENT SECTION FOR NO BUS TRAFFIC

LAYER	MATERIAL	MINIMUM THICKNESS, IN.
HMA Wearing Course	MDOT 5EL (1)	2.0 (2)
HMA Leveling Course	MDOT 4EL (1)	2.0
Aggregate Base	MDOT 21AA Crushed Limestone or Natural Aggregate	8.0
Sand Subbase	Class II Sand	10.0

NOTES:
(1) As modified in Section 5.3.1 – HMA Material Recommendations.
(2) Wearing course thickness may reduce to 1.5 inches thick in light-duty (car parking) areas where regular truck or heavy vehicle traffic will not occur.

TABLE 5: HEAVY-DUTY HMA PAVEMENT SECTION – BUS LOOP

LAYER	MATERIAL	THICKNESS (IN.)
HMA Wearing Course	MDOT 5EL (1)	2.0
HMA Leveling Course	MDOT 4EL (1)	3.0
Aggregate Base	MDOT 21AA Natural Aggregate or Crushed Limestone	10.0
Sand Subbase	Class II Sand	10.0

NOTES:
(1) As modified in Section 5.3.1 – HMA Material Recommendations

5.3.1 HMA MATERIAL RECOMMENDATIONS

We recommend following the MDOT 2020 Standard Specifications for Construction as related to the proposed pavement construction except as modified herein. The final asphalt binder grade should be PG 64-28 for the wearing course and PG58-28 for the leveling course. The amount of Reclaimed Asphalt Pavement (RAP) should be limited to MDOT Tier 1 (0 to 17 percent RAP binder by weight) for wearing course mixtures and MDOT Tier 2 (18 to 27 percent RAP binder by weight) for leveling course mixtures.

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The HMA mixture should be designed for target air voids of 3.5 percent and the in-place mix should be compacted to between 94 to 97 percent of the theoretical maximum density as determined per ASTM D2041. We recommend a bond coat of SS-1h emulsion be required between HMA layers at a rate of 0.1 gallons/s.y. If a significant time elapses between the placement of subsequent pavement layers, the existing pavement surface should be evaluated, and the surface should be suitably cleaned to remove dust and debris prior to placing the bond coat.

5.3.2 AGGREGATE BASE MATERIAL CONSIDERATIONS

The aggregate base should be compacted to a minimum of 95 percent of the maximum dry density determined in accordance with ASTM D1557. We recommended extending the aggregate base layer a minimum of 1-foot beyond the edge of pavement or back of curb/sidewalk to provide edge support.

5.4 PAVEMENT DRAINAGE CONSIDERATIONS

The pavement system must be properly drained to reduce the potential of frost heaving and softening of the subgrade due to water infiltrating through cracks. The infiltrated water, if not properly drained, is expected to adversely affect the pavement performance. Where feasible, we recommend that the drives be constructed using a crowned section and curb inlets as opposed to inverted crown drainage with catch basins. A crowned section should improve removal of water from the pavement drive lane areas and improve pavement performance. If inverted crown drainage is utilized, we recommend continuous underdrains be installed along the centerline of the drive.

We recommend extending the drains a minimum of 25-feet along the uphill direction at curb inlets and a minimum of 25 feet in four radial directions from catch basins located at low points. The drains should be connected to proposed drainage structures. The drain trenches should be excavated to a minimum depth of 18 inches below the bottom of the aggregate base and should be at least 12-inches wide. The drains should consist of a minimum 6-inch-diameter, polyethylene, perforated corrugated pipe. The trench should be wrapped in a non-woven geotextile fabric and backfilled with aggregate meeting MDOT 34R gradational requirements (pea stone). The fabric should be overlapped on top. The trench should be backfilled to the proposed bottom elevation of the aggregate base.

5.5 PAVEMENT CONSTRUCTION NOTES

To provide adequate service life and protect the pavement investment, we present the following construction notes. Include the following notes in the project specifications and implement during the construction activities:

1. Earthwork and pavement construction must be performed in accordance with the 2020 MDOT Standard Specifications for Construction unless otherwise noted in this report.
2. Earthwork and pavement construction are recommended during the summer months of June through September. Summer conditions are preferred to reduce the potential for disturbance of the subgrade soils due to relatively cold temperatures and precipitation.
3. Remove any existing topsoil, organic soils, and other undesirable materials to expose a suitable subgrade. Tree roots must be removed.
4. Excavate to the depth of the final subgrade elevation to allow for grade changes and the placement of the recommended pavement system.
5. The top 12 inches of the exposed subgrade as well as individual engineered fill layers shall be compacted to achieve a minimum of 95 percent of the maximum Modified Proctor dry density. Manipulate the moisture content to within (plus or minus) 2 percentage points of optimum moisture.

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6. The final subgrade shall be thoroughly proofrolled using a loaded tandem axle truck under the observation of a geotechnical/pavement engineer. Remove and replace loose or yielding areas that cannot be mechanically stabilized with engineered fill or as dictated by field conditions and recommended by a geotechnical/pavement engineer.
7. The aggregate base shall be compacted to achieve a minimum of 95 percent of the maximum Modified Proctor dry density. The aggregate base and subgrade compaction must extend a minimum of 12 inches beyond the paved edge or back of new concrete curb. Backfill behind unsupported concrete curbs and gutters to provide lateral resistance.
8. All HMA material shall be compacted to a density of 94 to 97 percent of the theoretical maximum density as determined by the Rice Method.
9. A bond coat of SS-1H emulsion is required between the leveling course and the wearing course. The bond coat must be applied in a uniform manner over the surface at a rate of 0.1 gallons/s.y.
10. Performance grade PG64-28 asphalt binder shall be used in the production of the wearing course HMA mixtures, and PG58-28 asphalt binder shall be used in the production of the leveling course HMA mixtures. Limit the amount of Reclaimed Asphalt Pavement (RAP) to MDOT Tier 1 (0 to 17 percent RAP binder by weight) in the surface (wearing) course and MDOT Tier 2 (18 to 27 percent RAP binder by weight) in leveling course.
11. Final pavement elevations shall be so designed to provide positive surface drainage. A minimum surface slope of 1.5 percent is recommended.
12. Install interceptor drains along the perimeter of paved areas where runoff from higher ground would flow towards the pavement. Finger drains must be installed at catch basins and gutter inlets.

6. SIGNATURES

We appreciate the opportunity to work with you on this project. There are many benefits in retaining the geotechnical engineer of record involved with the project, SME, for additional engineering support and observation and testing during construction. Please let us know if you have any questions and if we can assist you further with this project.

REPORT PREPARED BY:

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REPORT REVIEWED BY:

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Senior Project Engineer
Geotechnical Services

REPORT REVIEWED BY:

Zachary L. Miller, PE
Senior Project Engineer
Pavement Services

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APPENDIX A

BORING LOCATION DIAGRAM (FIGURE NO. 1)
BORING LOG TERMINOLOGY
BORING LOGS (B1 THROUGH B12 AND P1 THROUGH P4)
USACE DCP DATA SHEETS (P1 THROUGH P4)

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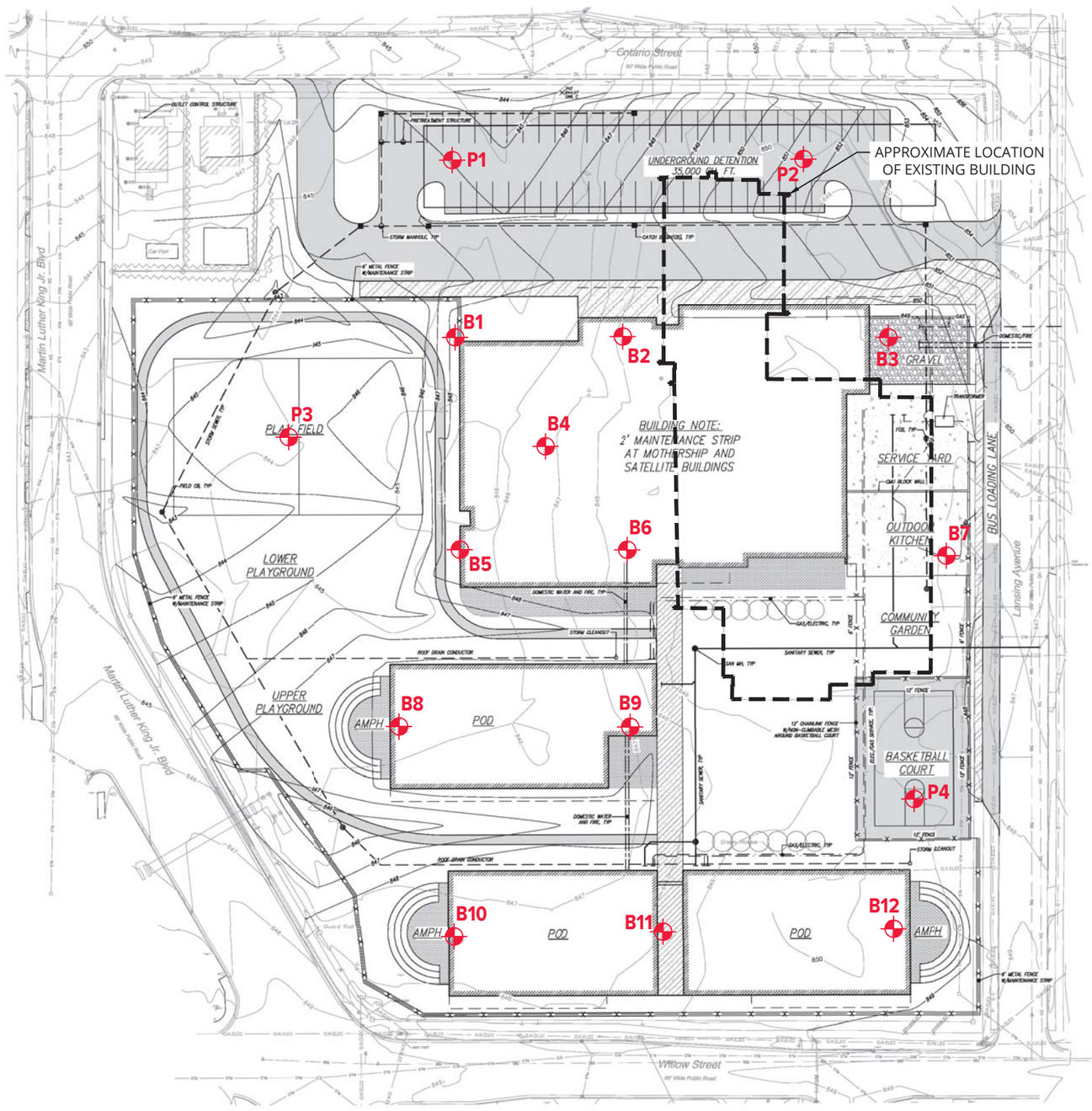

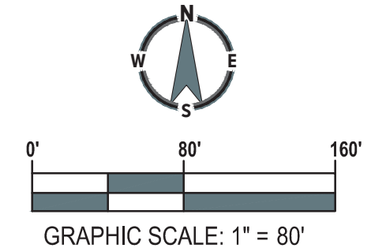

LEGEND

APPROXIMATE BORING LOCATION

LOCATION MAP

NOT TO SCALE

NOTES:

1. BASE DRAWING INFORMATION TAKEN FROM A DRAWING TITLED "C1.1 GENERAL PLAN CIVIL" PROVIDED TO SME ON MAY 3, 2023 AND PREPARED BY KINGSCOTT ASSOCIATES, INC.
2. AERIAL IMAGE TAKEN FROM GOOGLE EARTH PRO WITH AN IMAGE DATE OF 7-17-2021.

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www.sme-usa.com

Project
WILLOW K-8 SCHOOL

Project Location
1012 WEST
WILLOW STREET
LANSING, MICHIGAN

Sheet Name
BORING LOCATION DIAGRAM

No.	Revision Date

Date	5-19-2023
CADD	MNR
Designer	GBS
Scale	AS NOTED
Project	092683.00
Figure No.	1

DRAWING NOTE: SCALE DEPICTED IS MEANT FOR 11" X 17" AND WILL SCALE INCORRECTLY IF PRINTED ON ANY OTHER SIZE MEDIA

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BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)		
		GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)		
		GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)		
		SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)		
		SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt Concrete, Glacial Till, Siltstone, Aggregate Base, Coal, Limestone, Portland Cement Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

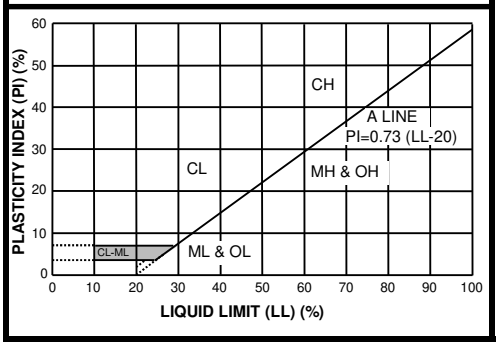
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressuremeter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES

The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:

Trace	–	particles are present but estimated to be less than 5%
Few	–	5 to 10%
Little	–	15 to 25%
Some	–	30 to 45%
Mostly	–	50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N_{60} (N-Value) (Blows per foot)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	Over 81

Cohesive Soils

Consistency	N_{60} (N-Value) (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	<2	0.25 or less
Soft	2 - 4	> 0.25 to 0.50
Medium	5 - 8	> 0.50 to 1.0
Stiff	9 - 15	> 1.0 to 2.0
Very Stiff	16 - 30	> 2.0 to 4.0
Hard	> 30	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

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SME

BORING B 1

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/6/23 **COMPLETED:** 4/6/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 845 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	SHEAR STRENGTH (KSF)	REMARKS
845	0	0.2 2 inches of ASPHALT PAVEMENT 844.8							
		0.7 FILL- 6 inches of SAND 844.3							
		2.0 FILL- Sandy LEAN CLAY- Occasional Sand Seams- Brown- Stiff (CL) 843.0	SB1	14	2 3 3	7	18		
		2.5 Sandy LEAN CLAY- Occasional Sand Seams- Dark Brown- Stiff (CL) 842.5							
		4.2 Sandy LEAN CLAY- Occasional Sand Seams- Gray- Very Stiff (CL) 840.8	SB2	16	4 4 4	9	20		
840	5	Fine to Medium CLAYEY SAND- Gray- Moist- Loose (SC)	SB3	13	3 4 3	8			
		8.0 837.0							
835	10	Sandy LEAN CLAY- Occasional Sandy Silt Seams- Brown- Very Stiff (CL)	SB4	12	6 7 7	15	11		
		12.0 833.0							
830	15	Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB5	16	8 10 11	23	11	4.5+	
		18.0 827.0							
825	20	LEAN CLAY- Occasional Silt Seams- Gray- Very Stiff (CL)	SB6	13	6 7 9	17	30		
		23.0 822.0							
		Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB7	15	7 7 7	15	10	4.5+	
820	25	25.0 820.0							
		END OF BORING AT 25.0 FEET.							
815	30								

HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	837.0
▼ AT END OF BORING:	7.0	838.0

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug and cold patch after backfilling the borehole.

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SME

BORING B 2

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/4/23 **COMPLETED:** 4/4/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 848± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 82% DATE: 9/29/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	SHEAR STRENGTH (KSF)	REMARKS
	0	0.5 6 inches of TOPSOIL 847.5							
845		Sandy LEAN CLAY- Occasional Sand Seams- Brown- Stiff to Very Stiff (CL)	SB1	14	3 3 3	8	21		
	5		SB2	18	3 4 3	10	18		
			SB3	16	4 3 4	10	12		
840		8.0 840.0							
	10	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Hard (CL)	SB4	13	10 11 17	38	12	4.5+	
		12.0 836.0							
835		Fine to Medium SAND with Silt- Gray- Moist (SP-SM)							
		14.0 834.0	SB5		13 10 11	29	13	4.5+	
	15								
830		Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard to Very Stiff (CL)	SB6	16	7 7 7	19	11		
	20								
825			SB7	13	7 9 10	26	12		
	25	25.0 823.0							
		END OF BORING AT 25.0 FEET.							
820									
	30								

HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	3.0	845.0
▼ AT END OF BORING:	8.0	840.0

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 3

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/6/23 **COMPLETED:** 4/6/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 848.4 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU) / SHEAR STRENGTH (KSF)	REMARKS
	0 – 0.3	3 inches of TOPSOIL							
845	0.3 – 8.0	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff to Hard (CL)	SB1	16	4 6 7	14	13		
			SB2	18	6 7 6	14	12	4.5+	
			SB3	13	9 10 12	24	12	4.5+	
840	8.0 – 17.0	Fine to Medium SAND with Silt- Brown- Moist- Medium Dense (SP-SM)	SB4	16	10 8 11	21			
835			SB5	11	7 8 7	16			
830	17.0 – 22.0	Fine SILTY SAND with Gravel- Gray- Wet- Dense (SM)	SB6	14	13 14 16	33			
825	22.0 – 25.0	Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB7		31 39 36	81	10	4.5+	
	25.0	END OF BORING AT 25.0 FEET.							
820									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	17.0	831.4
▼ AT END OF BORING:	18.0	830.4

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 4

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/6/23 **COMPLETED:** 4/6/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 846.6 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU) / SHEAR STRENGTH (KSF)	REMARKS
	0	0.2 2 inches of TOPSOIL 846.4							
845		Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff to Medium (CL)	SB1	16	2 3 3	7	17		
	5		SB2	18	3 2 3	5	18		
840			SB3	14	2 2 3	5	21		
		8.0 838.6							
	10	Sandy LEAN CLAY- Occasional Silty Sand Seams- Brown- Hard (CL)	SB4	13	10 10 17	29	12	4.5+	
835		12.0 834.6							
	15	Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB5	14	16 19 17	39	11	4.5+	
830		17.0 829.6							
	20	LEAN CLAY- Occasional Silty Sand Seams- Gray- Stiff (CL)	SB6	16	13 12 13	27	20		
		21.0 825.6							
825		Fine to Medium SAND with Silt- Brown- Wet- Very Dense (SP-SM)	SB7	12	22 25 32	62			
	25	25.0 821.6							
		END OF BORING AT 25.0 FEET.							
820									
	30								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	3.0	843.6
▼ AT END OF BORING:	10.0	836.6

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 5

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/7/23 **COMPLETED:** 4/7/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 845.5 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	SHEAR STRENGTH (KSF)	REMARKS
845	0	FILL- Sandy LEAN CLAY with Gravel- Occasional Topsoil Seams- Brown- Medium (CL)							
	1.4	844.1	SB1	13	6 4 5	10	22		
		Sandy LEAN CLAY- Occasional Silty Sand and Sand Seams- Brown- Very Stiff (CL)	SB2	16	4 6 6	13	14		
840	5		SB3	10	6 5 6	12	14		
			SB4	14	12 16 17	36	13		
835	10								
	12.0	833.5							
		Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB5	16	12 13 15	30	13		
830	15								
	17.0	828.5							
		CLAYEY SILT- Gray- Stiff to Very Stiff (ML)	SB6	16	6 8 7	16	20		
825	20								
			SB7	14	6 7 7	15	21		
	25.0	820.5							
820	25	END OF BORING AT 25.0 FEET.							
	30								

HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	1.0	844.5
▼ AT END OF BORING:	3.0	842.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 6

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/6/23 **COMPLETED:** 4/6/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 848.2 FT

HAMMER EFFICIENCY: 65%
DATE: 8/4/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY	MOISTURE	SHEAR STRENGTH	REMARKS
	0.3	3 inches of TOPSOIL (848.0)							
845		Sandy LEAN CLAY- Occasional Sand Layers- Brown- Very Stiff to Medium (CL)	SB1	16	3 4 4	9	16		
			SB2	12	3 4 4	9	23		
			SB3	15	4 3 5	9	22		
840	8.0	Fine to Medium SAND with Gravel- Brown- Wet (SP) (840.2)							
	9.0	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff (CL) (839.2)	SB4	13	10 9 10	21	14		Sample SB4 was too disturbed to perform a shear strength test.
	12.0	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Hard (CL) (836.2)							
835			SB5	16	12 19 22	44	13	4.5+	
	17.0	LEAN CLAY with Sand- Occasional Silty Sand Seams- Gray- Stiff (CL) (831.2)							
830			SB6	16	10 10 12	24	28		
	21.0	Fine SILTY SAND- Brown- Moist- Very Dense (SM) (827.2)							
825			SB7	12	21 22 34	61			
	25.0	END OF BORING AT 25.0 FEET. (823.2)							
820									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	840.2
▼ AT END OF BORING:	8.0	840.2

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 7

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/6/23 **COMPLETED:** 4/6/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 848.3 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU) / SHEAR STRENGTH (KSF)	REMARKS
	0	FILL- Sandy LEAN CLAY- Occasional Sand Seams- Dark Brown- Stiff (CL)	SB1	14	4 3 3	7	15		
845.3	3.0								
		Sandy LEAN CLAY- Occasional Sand Seams- Brown- Stiff to Hard (CL)	SB2	16	4 3 5	9	25		
			SB3	12	5 5 5	11	16		
			SB4	16	11 11 14	27	14	4.5+	
			SB5	13	7 8 7	16	13		
831.3	17.0								
		Fine SILTY SAND- Brown- Wet- Very Dense (SM)	SB6	16	19 18 29	51			
			SB7	14	32 34 38	78			
823.3	25.0	END OF BORING AT 25.0 FEET.							

Elevation scale: 845, 840, 835, 830, 825, 820
Depth scale: 0, 5, 10, 15, 20, 25, 30

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	840.3
▼ AT END OF BORING:	14.0	834.3

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 8

BORING DEPTH: 25 FEET

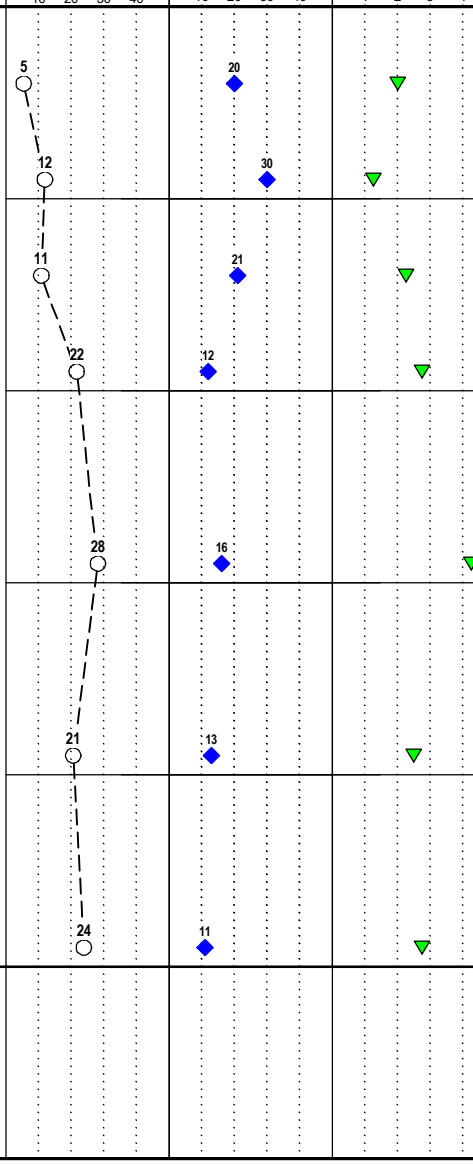
PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/7/23 **COMPLETED:** 4/7/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 845.4 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	SHEAR STRENGTH (KSF)	REMARKS
845	0	0.7 8 inches of TOPSOIL 844.7							
		Sandy LEAN CLAY- Occasional Root Fibers above 3 feet and Sand Seams- Brown and Gray- Stiff to Very Stiff (CL)	SB1	16	2 3 2	5	20		
			SB2	18	4 5 6	12	30		
840	5		SB3	13	4 4 6	11	21		
			SB4	16	8 9 11	22	12		
835	10	12.0 833.4							
		Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard to Very Stiff (CL)	SB5	13	12 11 15	28	16		
830	15								
			SB6	14	9 10 9	21	13		
825	20								
			SB7	16	11 10 12	24	11		
820	25	25.0 820.4 END OF BORING AT 25.0 FEET.							
	30								

HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)



GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	1.0	844.4
▼ AT END OF BORING:	3.0	842.4

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B 9

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/3/23 **COMPLETED:** 4/3/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 847.1 FT

HAMMER EFFICIENCY: 82%
DATE: 9/29/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MOISTURE (%)	SHEAR STRENGTH (KSF)	REMARKS
	0.8	9 inches of TOPSOIL (846.4)							
845	3.0	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Stiff (CL) (844.1)	SB1	16	2 2 3	7	19		
	8.0	LEAN CLAY with Sand- Occasional Silt Seams- Brown- Hard to Very Stiff (CL) (839.1)	SB2	14	6 10 9	26	19	4.5+	
840			SB3	12	7 7 7	19	15		
	11.0	CLAYEY SILT- Occasional Sand Seams- Brown- Stiff (ML) (836.1)	SB4	16	4 6 5	15	27		
835	17.0	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Hard (CL) (830.1)	SB5	13	7 8 10	25	10	4.5+	
830	25.0	Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL) (822.1)	SB6	16	8 8 11	26	12	4.5+	
825			SB7	18	9 8 9	23	11	4.5+	
		END OF BORING AT 25.0 FEET.							
820									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	3.0	844.1
▼ AT END OF BORING:	12.0	835.1

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

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SME

BORING B10

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/7/23
COMPLETED: 4/7/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR
RIG NO.: 525 (CME 550RT)
LOGGED BY: SMM
CHECKED BY: BLE

ELEVATION: 847.7 FT

HAMMER EFFICIENCY: 65%
DATE: 8/4/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MOISTURE (%)	SHEAR STRENGTH (KSF)	REMARKS
	0.5	6 inches of TOPSOIL (847.2)							
845		Sandy LEAN CLAY- Occasional Sand Seams- Brown- Stiff to Medium (CL)	SB1	13	4 4 5	10	13		
			SB2	16	5 6 5	12	15		
840			SB3	14	5 6 6	13	14		
			SB4	16	6 6 6	13	13		
	12.0	(835.7)							
835		Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard (CL)	SB5	13	16 13 21	37	10	4.5+	
830			SB6	16	21 20 23	47	9	4.5+	
825	23.0	(824.7)							
		LEAN CLAY with Sand- Occasional Silt Seams- Gray- Very Stiff (CL)	SB7	12	18 19 25	48	17		
	25.0	(822.7)							
820		END OF BORING AT 25.0 FEET.							

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	10.0	837.7
▼ AT END OF BORING:	12.0	835.7

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B11

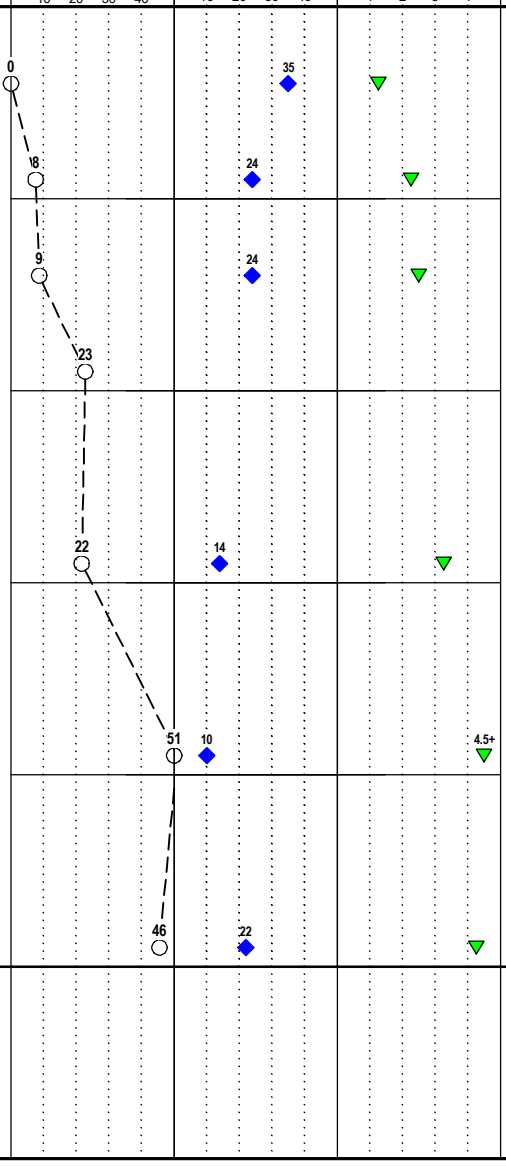
BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/7/23 **COMPLETED:** 4/7/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 525 (CME 550RT) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 847.9 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 65% DATE: 8/4/2022 N_{60} -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU) / SHEAR STRENGTH (KSF)	REMARKS
	0	FILL- Sandy LEAN CLAY- Occasional Sand Seams and Root Fibers- Dark Brown- Stiff (CL)	SB1		0 0 0	0	35		
845	3.0 / 844.9								
	5	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff (CL)	SB2	16	3 3 4	8	24		
			SB3	14	4 4 4	9	24		
840	8.0 / 839.9	SANDY SILT- Brown- Wet- Medium Dense (ML)	SB4	13	10 9 12	23			
	9.2 / 838.7	Fine to Coarse SAND with Gravel- Brown- Wet- Medium Dense (SP)							
	10 / 11.0 / 836.9								
835	15	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff (CL)	SB5	16	10 10 10	22	14		
	17.0 / 830.9								
830	20	LEAN CLAY with Sand- Occasional Silty Sand Seams- Gray- Hard (CL)	SB6	13	20 22 25	51	10	4.5+	
825	25 / 25.0 / 822.9		SB7	16	19 18 24	46	22		
		END OF BORING AT 25.0 FEET.							
820	30								



GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	839.9
▼ AT END OF BORING:	10.0	837.9

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.

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SME

BORING B12

BORING DEPTH: 25 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/3/23 **COMPLETED:** 4/3/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 849.5 FT

HAMMER EFFICIENCY: 82%
DATE: 9/29/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY	MOISTURE (%)	SHEAR STRENGTH (KSF)	REMARKS
	0	4 inches of ASPHALT PAVEMENT (0.3, 849.2)							
		FILL- Fine to Medium SAND with Gravel- Occasional Asphalt Fragments- Dark Brown and Black- Moist- Medium Dense (SP) (3.0, 846.5)	SB1	12	7 6 8	19			
845	5	Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff (CL)	SB2	15	3 4 4	11	18		
			SB3	16	3 4 3	10	19		
840	10		SB4	13	8 7 8	21	13		
		(12.0, 837.5)							
835	15	Sandy LEAN CLAY- Occasional Sand Seams- Gray- Hard to Very Stiff (CL)	SB5	14	10 10 12	30	14	4.5+	
830	20		SB6	14	13 11 14	34	15		
825	25	(25.0, 824.5)	SB7	16	6 6 7	18	10		
		END OF BORING AT 25.0 FEET.							
820	30								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	841.5
▼ AT END OF BORING:	22.0	827.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug and cold patch after backfilling the borehole.

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SME

BORING P1

BORING DEPTH: 10 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/4/23 **COMPLETED:** 4/4/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 844.5 FT

HAMMER EFFICIENCY: 82%
DATE: 9/29/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY	MOISTURE	SHEAR STRENGTH	REMARKS
	0.6	7 inches of TOPSOIL (843.9)							
	4.0	FILL- Sandy LEAN CLAY- Occasional Sand Seams- Brown- Very Stiff (CL) (840.5)	SB1	11	3 4 3	10	14		
840			SB2	16	2 2 2	5	31		
	8.0	Sandy LEAN CLAY- Occasional Sand Seams- Dark Brown- Stiff (CL) (836.5)	SB3	13	2 2 2	5	27		
835	10.0	Sandy LEAN CLAY- Frequent Sand Seams- Gray and Brown- Very Stiff (CL) (834.5)	SB4	16	4 5 4	12	12		
		END OF BORING AT 10.0 FEET.							

Depth scale: 0, 5, 10, 15, 20, 25, 30
Elevation scale: 840, 835, 830, 825, 820, 815

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	6.0	838.5
▼ AT END OF BORING:	6.0	838.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.
4. Army Corps of Engineers DCP test performed at this location. Refer to DCP data sheet for this boring.

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SME

BORING P2

BORING DEPTH: 10 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/4/23 **COMPLETED:** 4/4/23 **BORING METHOD:** Hollow-stem Augers

DRILLER: JR **RIG NO.:** 552 (CME 55) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 849.5 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N60 (HAMMER EFFICIENCY: 82% DATE: 9/29/2022)
	0	FILL- Fine SAND with Silt- Brown- Moist- Loose to Medium Dense (SP-SM)	SB1	16	5 5 6	15
845	5		SB2	18	5 3 4	10
			SB3	15	3 4 5	12
840	10	10.0 / 839.5	SB4	18	4 4 5	12
	10	END OF BORING AT 10.0 FEET.				
835	15					
830	20					
825	25					
820	30					

DRY DENSITY (pcf) -- ■ (90 100 110 120)
MOISTURE & ATTERBERG LIMITS (%) (PL MC LL) (10 20 30 40)
SHEAR STRENGTH (KSF) (1 2 3 4): ▼ HAND PENE. ☒ TORVANE SHEAR ● UNC. COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU)

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.
4. Army Corps of Engineers DCP test performed at this location. Refer to DCP data sheet for this boring.

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BORING P3

BORING DEPTH: 10 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan

DATE STARTED: 4/5/23 **COMPLETED:** 4/5/23 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55) **LOGGED BY:** SMM **CHECKED BY:** BLE

ELEVATION: 843.9 FT

HAMMER EFFICIENCY: 82%
DATE: 9/29/2022
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
	0	Fine SAND with Silt- Dark Brown- Moist to Wet- Very Loose (SP-SM)	SB1	14	0 1 1	3			
	3.0 / 840.9								
840	5	Fine SAND with Silt- Brown- Wet- Medium Dense (SP-SM)	SB2	16	3 3 5	11			
			SB3	12	3 4 5	12			
835	9.0 / 834.9	Sandy LEAN CLAY- Occasional Silty Sand Seams- Gray- Medium (CL)	SB4	14	5 6 5	15	19		
	10.0 / 833.9	END OF BORING AT 10.0 FEET.							
830	15								
825	20								
820	25								
815	30								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	1.0	842.9
▼ AT END OF BORING:	1.0	842.9

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug after backfilling the borehole.
4. Army Corps of Engineers DCP test performed at this location. Refer to DCP data sheet for this boring.

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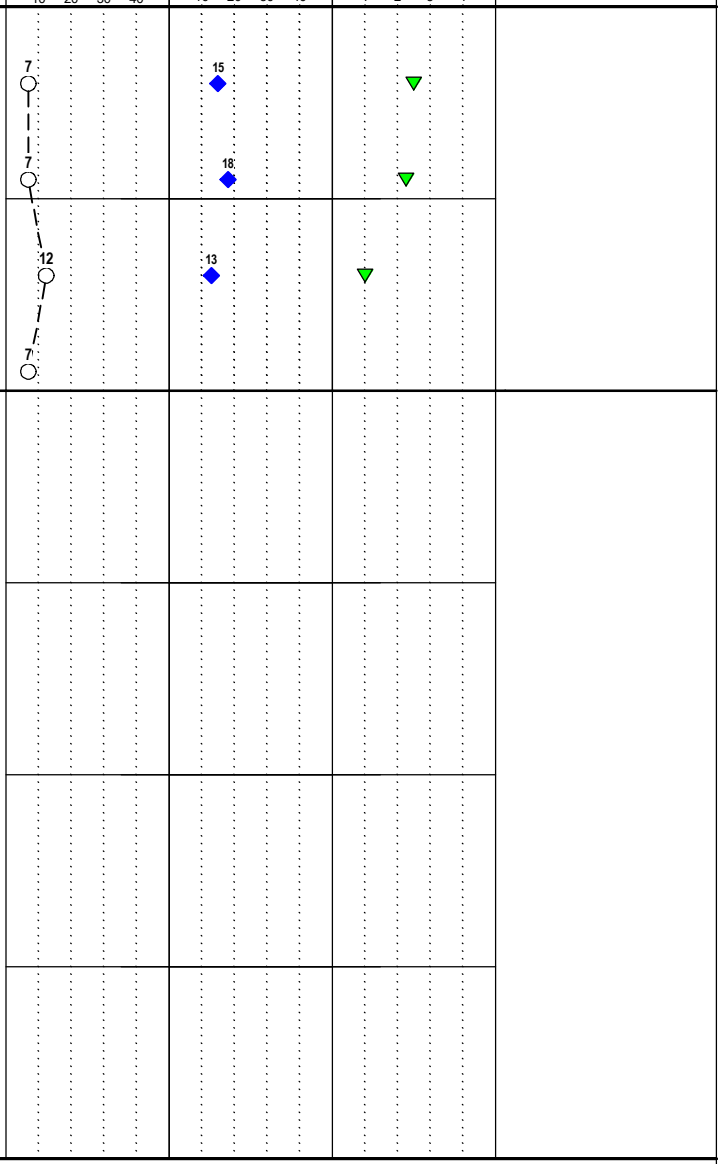
BORING P4

BORING DEPTH: 10 FEET

PROJECT NAME: Willow K-8 School
PROJECT NUMBER: 092683.00
CLIENT: Plante Moran Cresa
PROJECT LOCATION: Lansing, Michigan
DATE STARTED: 4/3/23 **COMPLETED:** 4/3/23
BORING METHOD: Hollow-stem Augers
DRILLER: JR **RIG NO.:** 552 (CME 55)
LOGGED BY: SMM **CHECKED BY:** BLE

ELEVATION: 848.8 FT

HAMMER EFFICIENCY: 82%
DATE: 9/29/2022
N_{60} -- ○



DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)
HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY	MOISTURE	SHEAR STRENGTH	REMARKS
	0.3	4 inches of ASPHALT PAVEMENT (848.5)							
	0.8	5 inches of SAND and GRAVEL (848.1)							
845	6.0	FILL- Sandy LEAN CLAY- Occasional Sand Seams- Gray- Very Stiff (CL) (842.8)	SB1	16	4 2 3	7	15		
			SB2	14	2 2 3	7	18		
	8.0	Sandy LEAN CLAY- Few Gravel- Occasional Sand Seams- Dark Brown- Stiff (CL) (840.8)	SB3	3	4 5 4	12	13		
840	10.0	Fine to Medium CLAYEY SAND- Few Gravel- Brown- Wet- Loose (SC) (838.8)	SB4	11	2 2 3	7			
		END OF BORING AT 10.0 FEET.							

Depth scale: 0, 5, 10, 15, 20, 25, 30
Elevation scale: 845, 840, 835, 830, 825, 820

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	8.0	840.8
▼ AT END OF BORING:	8.0	840.8

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. Surface capped with EPCO hole plug and cold patch after backfilling the borehole.
4. Army Corps of Engineers DCP test performed at this location. Refer to DCP data sheet for this boring.

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USACE DCP DATA SHEET

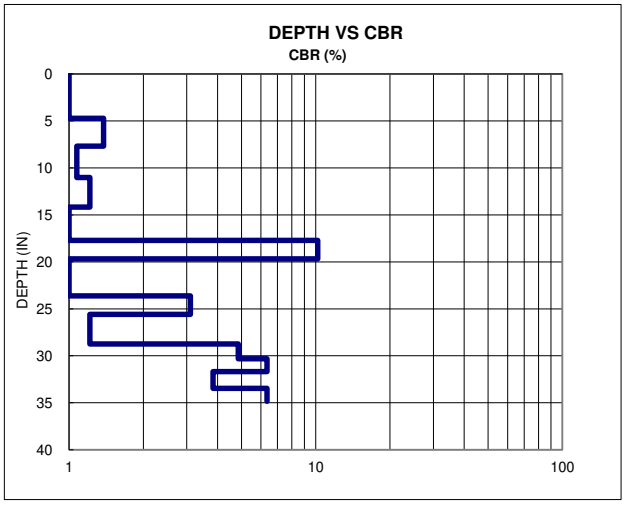
PROJECT: Willow K-8 School
PROJECT NO.: 092683.00
LOCATION: Lansing, Michigan
CLIENT: Plante Moran Cresa LLC
DATE: 4/4/23
BY: JR
DEPTH TO START OF TEST FROM SURFACE: 0 inches

BORING: P1
GROUND EL.: 844.5 FT

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	160	0						
3	280	120	40	2	0.5	4.7	Topsoil	
3	355	75	25	2	1.4	7.7	Topsoil	0.9
3	440	85	28	2	1.1	11.0	Very Poor	
3	520	80	27	2	1.2	14.2	Very Poor	
3	610	90	30	2	1.0	17.7	Very Poor	
5	660	50	10	2	10.2	19.7		
3	760	100	33	2	0.8	23.6	Very Poor	
3	810	50	17	2	3.1	25.6	Poor	
3	890	80	27	2	1.2	28.7	Very Poor	
3	930	40	13	2	4.9	30.3	Poor	2.3
3	965	35	12	2	6.3	31.7		
3	1010	45	15	2	3.8	33.5	Poor	
3	1045	35	12	2	6.3	34.8		5.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES: 1) Refer to corresponding Boring Log for soil and groundwater information.



CBR Ranges for Subgrade Conditions

CBR< 3: Very Poor
CBR 3-5: Poor
CBR 5-10: Marginal
CBR >10: Good

Depth to Groundwater From Surface

During Drilling: **See Note 1**
Upon Completion: **See Note 1**

Depth of Frost From Surface : **See Note 1**

From	To	Material
		See Note 1

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USACE DCP DATA SHEET

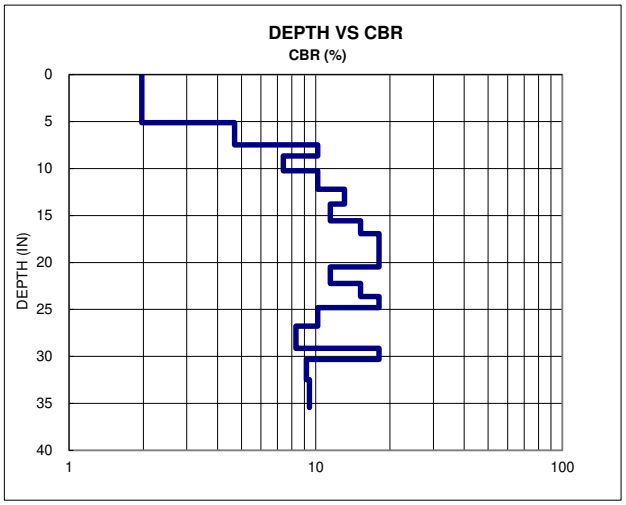
PROJECT: Willow K-8 School
PROJECT NO.: 092683.00
LOCATION: Lansing, Michigan
CLIENT: Plante Moran Cresa LLC
DATE: 4/4/23
BY: JR
DEPTH TO START OF TEST FROM SURFACE: 0 inches

BORING: P2
GROUND EL.: 849.5 FT

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	150	0						
3	280	130	43	2	2.0	5.1	Very Poor	
3	340	60	20	2	4.7	7.5	Poor	2.8
3	370	30	10	2	10.2	8.7		
3	410	40	13	2	7.4	10.2		
5	460	50	10	2	10.2	12.2		
5	500	40	8	2	13.1	13.8		
5	545	45	9	2	11.5	15.6		
5	580	35	7	2	15.2	16.9		
5	610	30	6	2	18.1	18.1		
5	640	30	6	2	18.1	19.3		
5	670	30	6	2	18.1	20.5		
5	715	45	9	2	11.5	22.2		
5	750	35	7	2	15.2	23.6		
5	780	30	6	2	18.1	24.8		
5	830	50	10	2	10.2	26.8		
5	890	60	12	2	8.3	29.1		
5	920	30	6	2	18.1	30.3		
5	975	55	11	2	9.2	32.5		
7	1050	75	11	2	9.4	35.4		12.2

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES: 1) Refer to corresponding Boring Log for soil and groundwater information.



CBR Ranges for Subgrade Conditions

CBR< 3: Very Poor
CBR 3-5: Poor
CBR 5-10: Marginal
CBR >10: Good

Depth to Groundwater From Surface

During Drilling: **See Note 1**
Upon Completion: **See Note 1**

Depth of Frost From Surface : **See Note 1**

From	To	Material
		See Note 1

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USACE DCP DATA SHEET

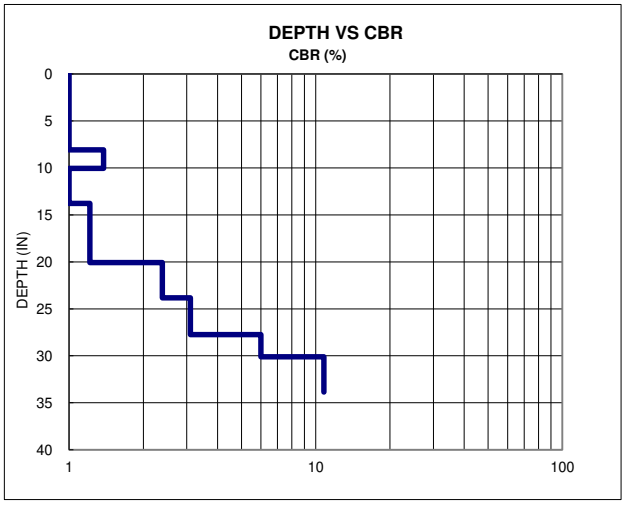
PROJECT: Willow K-8 School
PROJECT NO.: 092683.00
LOCATION: Lansing, Michigan
CLIENT: Plante Moran Cresa LLC
DATE: 4/4/23
BY: JR
DEPTH TO START OF TEST FROM SURFACE: 0 inches

BORING: P3
GROUND EL.: 843.9 FT

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	180	0						
1	270	90	90	2	0.1	3.5	Very Poor	
1	320	50	50	2	0.3	5.5	Very Poor	
2	385	65	33	2	0.8	8.1	Very Poor	
2	435	50	25	2	1.4	10.0	Very Poor	
3	530	95	32	2	0.9	13.8	Very Poor	
3	610	80	27	2	1.2	16.9	Very Poor	
3	690	80	27	2	1.2	20.1	Very Poor	
5	785	95	19	2	2.4	23.8	Very Poor	
6	885	100	17	2	3.1	27.8	Poor	1.4
5	945	60	12	2	6.0	30.1		
10	1040	95	10	2	10.8	33.9		8.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES: 1) Refer to corresponding Boring Log for soil and groundwater information.



CBR Ranges for Subgrade Conditions

CBR< 3: Very Poor
CBR 3-5: Poor
CBR 5-10: Marginal
CBR >10: Good

Depth to Groundwater From Surface

During Drilling: **See Note 1**
Upon Completion: **See Note 1**

Depth of Frost From Surface : **See Note 1**

From	To	Material
		See Note 1

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USACE DCP DATA SHEET

PROJECT: Willow K-8 School
PROJECT NO.: 092683.00
LOCATION: Lansing, Michigan
CLIENT: Plante Moran Cresa LLC
DATE: 4/4/23
BY: JR

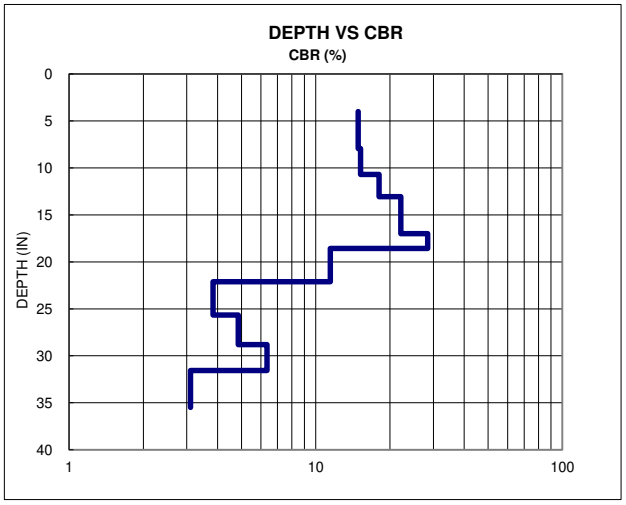
BORING: P4
GROUND EL.: 848.8 FT

DEPTH TO START OF TEST FROM SURFACE: 4 inches

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	330	0						
7	430	100	14	1	14.9	7.9		
5	500	70	14	1	15.2	10.7		
5	560	60	12	1	18.1	13.1		
5	610	50	10	1	22.2	15.0		
5	660	50	10	1	22.2	17.0		
5	700	40	8	1	28.4	18.6		
5	790	90	18	1	11.5	22.1		17.4
3	880	90	30	1	3.8	25.7	Poor	
3	960	80	27	1	4.9	28.8	Poor	
3	1030	70	23	1	6.3	31.6		
3	1130	100	33	1	3.1	35.5	Poor	4.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES: 1) Refer to corresponding Boring Log for soil and groundwater information.



CBR Ranges for Subgrade Conditions

CBR< 3: Very Poor
CBR 3-5: Poor
CBR 5-10: Marginal
CBR >10: Good

Depth to Groundwater From Surface

During Drilling: **See Note 1**
Upon Completion: **See Note 1**

Depth of Frost From Surface : **See Note 1**

From	To	Material
		See Note 1

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APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT
GENERAL COMMENTS
LABORATORY TESTING PROCEDURES

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

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responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

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LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

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SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 312000 "Earth Moving".

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: for undercut and replacement of poor soils.

1. Description: Unit price to include disposal of poor soils and import and placement of 1” x 3” crushed concrete or 21AA crushed concrete with geotextile fabric up to proposed subgrade elevation.
2. Unit of measurement: Cubic yard of installed material.
3. Unit Price: Dollars per cubic yard.

END SECTION 012200

SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATE 1:
Add alternate: Construction of exterior wall construction using standard field assembled wall construction in lieu of prefabricated wall construction. Construction of system to meet specification requirements of Sto-Panel System “Back Up”.

B. ALTERNATE 2:
Add alternate to provide and install decorative black metal picket fence in lieu of black PVC chain-link fence around perimeter of building site.

C. ALTERNATE 3:
Add alternate to provide and install KEE roofing system in lieu of EPDM roofing system..

D. ALTERNATE 4:
Add alternate to provide and install concrete finish at the entire Service Yard in lieu of gravel.

E. ALTERNATE 5:
Add/deduct alternate to provide and install polished concrete with Level 1 and Level 3 as a in lieu of Level 2 finish.

F. ALTERNATE 6:
Add alternate to provide and install solid surface counter tops in lieu of paperstone.

END OF SECTION 012300

SECTION 013300
ARCHITECT'S SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting RFI's, Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Documents will be provided by Architect for Contractor's use in preparing submittals. See 1.4 below.

B. All submittals must be in electronic form. Paper copies are not acceptable unless specifically listed. The architect will review, stamp and return an electronic document for the contractor's use. Copies of the reviewed shop drawings shall be provided by the contractor for distribution as required by the Construction Manager.

C. Each submittal item shall be submitted in its entirety as one complete package including all information required to fully review the item. Material sample, data, warranty and maintenance information, and drawings shall come as one package. Submittals missing required components and / or without product selections identified will be rejected without review.

D. Compliance Certificate: Refer to the attached Compliance Certificate. Compliance Certificates are to be used by contractors to indicate the products/devices intended for use in this project without the need and time for product data submittals. Contractors shall use Compliance Certificates whenever possible to expedite the work and limit paper work. Items listed on the form must be approved products listed in the specifications. No substitutions allowed. Select one (1) source for each category, sign this sheet, and submit as the contractor's commitment to use products required by the contract documents. No further product data submittals are required for this section. Physical sample, color samples, or layout shop drawings must be submitted where required by the specification. Refer to the attached specification list for sections that are subject to this certificate. **NOTE: Not all specification sections listed below will apply to the project listed above. There might not be specification sections included that are in the**

project listed above, in that case coordinate with architect at post bid interview for submittal requirements.

E. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

F. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

G. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. RFI's, request for information: Allow 5 working days for initial response for each RFI. Allow additional time if coordination with subsequent RFI is required, or when additional information is need for the response.

2. Shop drawings, sample, and product data:

    a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

    b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

    c. Resubmittal Review: Allow 15 days for review of each resubmittal.

    d. Sequential Review: where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

    e. Submissions that are large or of multiple submissions or requires detailed or lengthy review by the Architect or his consultant may require additional time.

    f. Submissions for products or material that require a long lead time for delivery shall be noted as such and marked "Top Priority" so the architect may expedite the process. The architect will expedite reviews when the contractor legitimately can't submit within a reasonable time due to construction schedule. Failure to submit in a timely manner or to allow sufficient time for initial review and resubmittal reviews may result in project delays, additional service charges by the architect, or other penalties for the contractor.

H. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

I. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

J. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

K. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form including electronic submittals. Architect will discard submittals received from sources other than the Construction Manager. Architect will return any submittal with a transmittal, which doesn’t fully list, and properly identify the enclosed items.

L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked " Review or reviewed with comments."

M. Distribution: Furnish copies of reviewed submittals to the Construction Manager, manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

1.4 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to the Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. The Architect will provide, electronic data files, compatible with AutoCAD for contractor's convenience and use in the preparation of shop drawings. **Refer to Terms and Conditions at the end of this specification.** Requests for electronic data shall be in written form through the architect. Prior to the release of electronic files, the Architect will require a signed waiver of release. Contractors should allow a minimum of 1-week for this process.

PART 2 - RFI'S – REQUEST FOR INFORMATION

1. All RFI's shall be submitted to the Architect in electronic form. PDF's and Word files are acceptable.

2. PDF RFI forms shall include an editable text area for response, date, and signature.

3. RFI's shall be distributed by e-mail. E-mail title shall be specific to job name, and RFI number. This is mandatory for proper tracking.

4. Faxed and Hand written RFI's are not acceptable and will be rejected.

PART 3 - PRODUCTS

3.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submittal Types:
   a. Shop Drawing
   b. Product Data
   c. Sample
   d. Other

B. Kingscott Review Stamp Statement: "Reviewed only for the limited purpose of checking for conformance with the design concept expressed in the Contract Documents. Dimensions, quantities, accuracy, assembly methods, installation methods, coordination with other trades and field verification are the responsibility of the contractor."

1. The following Actions will be taken:
   a. Reviewed with no exceptions
   b. Reviewed with Exceptions
   c. Revise and resubmit
   d. Rejected

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Use the Material Compliance form when permitted and whenever possible to save time and paper work.
2. If information must be specially prepared for submittal because standard data are not suitable for use, submit as Shop Drawings, not as Product Data.
3. Mark each copy of each submittal to show which products and options are applicable. Unmarked submittals will be rejected. Failure to mark appropriate products will result in rejection of the submittal.
4. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Manufacturer's catalog cuts.
    e. Wiring diagrams showing factory-installed wiring.
    f. Printed performance curves.
    g. Operational range diagrams.
    h. Compliance with specified referenced standards.
    i. Testing by recognized testing agency.

5. Number of Copies: Submit one electronic copy of Product Data, unless otherwise indicated. Architect will return one electronic copy. See the Constriction Manager's submittal requirements for final record and distribution copy requirements.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shop work manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Notation of coordination requirements.
    j. Notation of dimensions established by field measurement.
    k. Relationship to adjoining construction clearly indicated.
    l. Seal and signature of professional engineer if specified.
    m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit one opaque (bond) copy, and one electronic copy of each submittal. Architect will return one electronic copy for printing and distribution.

E. Samples: **Submit Physical Samples** for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. **Scanned color charts, samples, etc. will be REJECTED. Send physical samples, color charts, etc. as described in each specification section.**

   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection**. Scanned color charts, samples, etc., will be REJECTED. Send physical samples, color charts, etc. as described in each specification section.**

   a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

3.2 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit four copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 4 - EXECUTION

4.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions prior to submission for review. It is the contractor's responsibility to review and identify major discrepancy with the contract dements, and significant missing information. Documents with discrepancies and substantially missing information shall be returned for revisions prior to submission to the Construction Manager.

B. Mark with approval stamp before submitting to the Construction Manager.

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

4.2 CONSTRUCTION MANAGER'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions prior to submission for review. It is the Construction Manager's responsibility to review and identify major discrepancy with the contract dements, and significant missing information. Documents with discrepancies and substantially missing information shall be returned for revisions prior to submission to the Architect.

B. Mark with approval stamp before submitting to Architect.

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

4.3 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's and Construction Managers approval stamp, and have not been fully reviewed and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Reviewed with no exceptions.
2. Reviewed with exceptions.
3. Revise and resubmit.
4. Rejected.

C. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

D. Incomplete submittals with substantial missing information, will be considered non-responsive, and will be returned without review.

E. Non-complaint submittals, will be considered non-responsive, and will be returned without review.

F. Submittals not required by the Contract Documents will not be reviewed and will be discarded.

SUMBITTALS REQUESTED BY SPECIFICATION SECTION						
This is a general guide, but may vary by project.						
Given the age of digital submittal, product information and images, and multiple files can be compiled into one complete product data page. When this complete product data sheet is submitted, it becomes an acceptable option to help limit physical samples and paper.						
SECTION. NO.	SECTION TITLE	PRODUCT DATA	SAMPLE	SHOP DRAWINGS	MATERIAL COMPLIANCE	TESTING
033000	CAST-IN-PLACE CONCRETE	X		X		X
042000	UNIT MASONRY/BRICK	X	X (BRICK)			
047200	CAST STONE	X	X			
051200	STRUCTURAL STEEL FRAMING			X		
052100	STEEL JOIST			X		
053100	STEEL DECKING				X	
054000	COLD-FORMED METAL FRAMING			X		
055000	METAL FABRICATIONS			X		
055113	METAL PAN STAIRS			X		
055213	PIPE AND TUBE			X		
061000	ROUGH CARPENTRY				X	
061053	MISCELLANEOUS ROUGH CARPENTRY				X	
061063	EXTERIOR ROUGH CARPENTRY				X	
061600	SHEATHING				X	
061753	SHOP-FABRICATED WOOD TRUSSES			X		
062013	EXTERIOR FINISH CARPENTRY		X		X	
062023	INTERIOR FINISH CARPENTRY		X		X	
071326	SELF-ADHERING SHEET	X			X	
072100	THERMAL INSULATION	X			X	
072119	FOAMED-IN-PLACE INSULATION	X			X	
072500	WEATHER BARRIERS	X			X	
072600	VAPOR RETARDERS	X			X	
073113	ASPHALT SHINGLES		X			

SECTION. NO.	SECTION TITLE	PRODUCT DATA	SAMPLE	SHOP DRAWINGS	MATERIAL COMPLIANCE	TESTING
074113.16	STANDING-SEAM METAL ROOF PANELS		X			
074213.13	FORMED METAL WALL PANELS		X	X		
074213.19	INSULATED METAL WALL PANELS		X	X		
075323	ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING			X		
075423	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING			X		
076200	SHEET METAL FLASHING AND TRIM		X			
077100	ROOF SPECIALTIES	X			X	
077129	MANUFACTURED ROOF EXPANSION JOINTS	X			X	
077200	ROOF ACCESSORIES	X			X	
078413	PENETRATION FIRESTOPPING				X	
078443	JOINT FIRESTOPPING				X	
079200	JOINT SEALANTS	X	X			
079219	ACOUSTICAL JOINT SEALANTS	X	X			
081213	HOLLOW METAL DOORS AND FRAMES			X		
081416	FLUSH WOOD DOORS		X	X		
083113	ACCESS DOORS AND FRAMES				X	
083313	COILING COUNTER DOORS			X		
083323	OVERHEAD COILING DOORS			X		
083513	FOLDING DOORS			X		
083613	SECTIONAL DOORS			X		

SECTION. NO.	SECTION TITLE	PRODUCT DATA	SAMPLE	SHOP DRAWINGS	MATERIAL COMPLIANCE	TESTING
084113	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS		X	X		
084413	GLAZED ALUMINUM CURTAIN WALLS		X	X		
084523	FIBERGLASS-SANDWICH-PANEL ASSEMBLIES	X			X	
085113	ALUMINUM WINDOWS		X	X		
087100	DOOR HARDWARE			X		
088000	GLAZING	X			X	
088300	MIRRORS				X	
089119	FIXED LOUVERS		X	X		
092116.23	GYPSUM BOARD SHAFT WALL ASSEMBLIES				X	
092216	NON-STRUCTURAL METAL FRAMING				X	
092900	GYPSUM BOARD				X	
093013	CERAMIC TILE	X			X	
095113	ACOUSTICAL PANEL CEILING				X	
096513	RESILIENT BASE & ACCESSORIES				X	
096516	RESILIENT SHEET VINYL	X				
096519	RESILIENT TILE FLOORING	X				
096566	RESILIENT ATHLETIC FLOORING	X				
096813	TILE CARPET	X				
096816	SHEET CARPET	X				
097200	WALL COVERINGS	X				
098433	SOUND ABSORBING WALL UNITS	X				
098436	SOUND ABSORBING CEILING UNITS	X				
099113	EXTERIOR PAINTING		X			
099123	INTERIOR PAINTING		X			
099600	HIGH PERFORMANCE COATINGS		X			

SECTION. NO.	SECTION TITLE	PRODUCT DATA	SAMPLE	SHOP DRAWINGS	MATERIAL COMPLIANCE	TESTING
101100	VISUAL DISPLAY BOARDS			X	X	
101200	DISPLAY CASES			X	X	
101423	PANEL SIGNAGE		X	X		
102113	TOILET COMPARTMENTS	X		X		
102116	SHOWER AND DRESSING COMPARTMENTS	X		X		
102123	CUBICAL CURTAINS AND TRACK	X			X	
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES (CONTRACTOR TO VERIFY QUANTITIES				X	
104413	FIRE PROTECTION CABINETS				X	
104416	FIRE EXTINGUISHERS				X	
105113	METAL LOCKERS		X	X		
105613	METAL SHELVING				X	
105626	MOBILE STORAGE SHELVING			X	X	
113100	RESIDENTIAL APPLIANCES				X	
115123	LIBRARY STACK SYSTEMS		X	X		
115213	PROJECTION SCREENS				X	
115313	LABORATORY FUME HOODS		X	X		
116143	STAGE CURTAINS		X	X		
116623	GYMNASIUM EQUIPMENT		X	X		
126600	TELESCOPING STANDS		X	X		
122113	HORIZONTAL BLINDS	X				
122413	VERTICLE BLINDS	X				
122413	ROLLER SHADES (OPERABLE SHOP DRAWINGS)	X		X	X	

SECTION. NO.	SECTION TITLE	PRODUCT DATA	SAMPLE	SHOP DRAWINGS	MATERIAL COMPLIANCE	TESTING
123___	CASEWORK AND COUNTERTOPS		X	X		
124816	ENTRANCE FLOOR GRILLS	X				

Material Compliance Form

Kingscott
259 East Michigan, Suite 308
Kalamazoo, MI 49007
800.632.7815 | kingscott.com

Name of Building:

Owner:

Bid Package #:

A/E #:

Cc:

Material Compliance Submittal Section:

This document is to be used by this contractor to indicate the products/devices intended for use in this project without the need for product data submittals. Items listed are approved products in the specifications. No substitutions allowed. Select one (1) source for each category, sign this sheet, and submit as the contractor's commitment to use products required by the contract documents. **No further product data submittals are required for this section. However, physical sample, color samples, or layout shop drawings must be submitted where required by the specification**.

As contractor for work specified under the section named above, I [illegible] to use only the products/devices listed below that were listed in the specification section.

Contractor:

Date:

Print Name: Filled out by Contractor

Title:

Signature: _____

Notary:

County:

Date Commission Expires: Filled out by Contractor and Notary used from Contractor

Print Name:

Signature: _____

Reviewed By: Construction Manager, Inc.

Date: Filled out by Construction Manager

Print Name:

Signature: _____

Reviewed By: Kingscott Associates, Inc.

Date:

Print Name: Filled out by Architect

Signature: _____

List the manufacturer's name and model number(s) [illegible] each item being submitted in this division. Provide all relevant information not covered by the model number [illegible] show full compliance with each requirement of the specification. This will include but is not limited to color, finish, size, thickness and all other selectable option. Note: Use location for each listed item when several different products in this division are used in specific locations.

Specification Section:	Manufacturer's Name:	Model Number:
096519	Shaw Commercial	Uncommon Ground 6 #0188V (LVT-1)
096519	Shaw Commercial	Skyline #02560 (LVT-2)
095113	Armstrong	#1713 (CP-1)
095113	Armstrong	#3101 (CP-2)
095113	Armstrong	Armstrong Prelude XL (ME-1 grid)
095113	Armstrong	Armstrong Axiom Classic Trim (ME-2 grid and trim)

SAMPLE

Material Compliance Form

Kingscott
259 East Michigan, Suite 308
Kalamazoo, MI 49007
800.632.7815 | kingscott.com

Name of Building:

Owner:

Bid Package #:

A/E #:

Cc:

Material Compliance Submittal Section:

This document is to be used by this contractor to indicate the products/devices intended for use in this project without the need for product data submittals. Items listed are approved products in the specifications. No substitutions allowed. Select one (1) source for each category, sign this sheet, and submit as the contractor's commitment to use products required by the contract documents. **No further product data submittals are required for this section. However, physical sample, color samples, or layout shop drawings must be submitted where required by the specification**.

As contractor for work specified under the section named above, I agree to use only the products/devices listed below that were listed in the specification section.

Contractor:

Date:

Print Name:

Title:

Signature: _____

Notary:

County:

Date Commission Expires:

Print Name:

Signature: _____

Reviewed By: Construction Manager, Inc.

Date:

Print Name:

Signature: _____

Reviewed By: Kingscott Associates, Inc.

Date:

Print Name:

Signature: _____

List the manufacturer's name and model number(s) below for each item being submitted in this division. Provide all relevant information not covered by the model number to show full compliance with each requirement of the specification. This will include but is not limited to color, finish, size, thickness and all other selectable option. Note: Use location for each listed item when several different products in this division are used in specific locations.

Specification Section:	Manufacturer's Name:	Model Number:

Kingscott
259 East Michigan, Suite 308
Kalamazoo, MI 49007
800.632.7815 | kingscott.com

Electronic Media Authorization

Signed waiver required prior to release

Project Name: _____ KAI Project# _____

Name : _____ Company: _____

Address: _____

City, State, Zip: _____

Phone: _____ Email: _____

Autocad file version: _____

Signature: _____ Date: _____

By signing, you are agreeing to the Terms and Conditions on the following page

Documents Requested: KAI DWG # Issued Date on DWG

_____

_____

_____

_____

Approved by: _____ Date:_____

Email form to:
rsingh@kingscott.com

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SECTION 024116
STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

   a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

D. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Store items in a secure area until delivery to Owner.
3. Transport items to storage area designated by Owner.
4. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

   a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings. Meet with Owner and Owner's representative prior to demolition activities to verify salvage items.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

E. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete materials.
2. Formwork.
3. Steel reinforcement.
4. Concrete materials.
5. Admixtures.
6. Vapor retarders.
7. Floor and slab treatments.
8. Liquid floor treatments.
9. Curing materials.
10. Accessories.
11. Repair materials.

B. Related Requirements:

1. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.
2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.
e. Special concrete finish Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold- and hot-weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Methods for achieving specified floor and slab flatness and levelness.
k. Floor and slab flatness and levelness measurements.
l. Concrete repair procedures.
m. Concrete protection.
n. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31)
o. Protection of field cured field test cylinders.
p. Distribution of test reports.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Aggregates.
8. Admixtures.
9. Color pigments.
10. Vapor retarders.
11. Floor and slab treatments.
12. Liquid floor treatments.
13. Curing materials.
14. Joint fillers.
15. Repair materials.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, length, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacings, hoop spacing, and supports for concrete reinforcement.

E. Samples: For manufacturer's standard colors for color pigment.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.

7. Aggregates.
8. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with ASTM E1155.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements.

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.

D. Field Quality-Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete slab-on-ground and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship. Provide up to two batches of concrete to demonstrate the number of required mockups.

1. Slab-on-Ground: Build panel in the location indicated or, if not indicated, as directed by Architect.

a. Divide panel into four equal panels to demonstrate saw joint cutting.

2. Formed Surfaces: Build panel in the location indicated or, if not indicated, as directed by Architect.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to, or is expected to fall below 40 deg F during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Plain Steel Welded-Wire Reinforcement: ASTM A1064, plain, flat sheets, size and gage as indicated on drawings.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

D. Tie Wire: Annealed, minimum 16 gage.

2.4 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I, Type II, Type I/II.
2. Blended Hydraulic Cement: ASTM C595.
3. Performance-Based Hydraulic Cement: ASTM C1157.
4. Fly Ash: ASTM C618, Class C or F
5. Slag Cement: ASTM C989, Grade 100 or 120.
6. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33, coarse aggregate or better, graded. Provide aggregates from a single source.
2. Maximum Coarse-Aggregate Size: per design mix requirements.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. Retarding Admixture: ASTM C494, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.

C. Color Pigment: ASTM C979, synthetic mineral-oxide pigments, color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Color:As selected by Architect from manufacturer's full range.

D. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01 or lower. Include manufacturer's recommended thickness and adhesive or pressure-sensitive tape.

2.7 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

C. Emery Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

1. Color: As selected by Architect from manufacturer's full range.

D. Metallic Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

1. Color: As selected by Architect from manufacturer's full range.

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
   1. Color: As selected by Architect from manufacturer's full range.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

D. Water: Potable water that does not cause staining of the surface.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B.

G. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.10 ACCESSORIES

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.11 CONCRETE MIXTURE, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.12 CONCRETE MIXTURES

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum w/cm Ratio: 0.49
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1 inch.
5. Maximum Aggregate Size: 1 1/2 inch.

B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm Ratio: 0.46
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Maximum Aggregate Size: 3/4 inch.

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construction formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct form tight enough to prevent loss of concrete mortar.

D. Fabricate form for easy removal without hammering or prying against concrete surfaces.

E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before placing concrete.

F. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing concrete.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides and sealing to vapor retarder.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directly into concrete, not toward exposed concrete surfaces.

E. Preserve clearance between bars of not less than 1 ich, not less than on bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

F. Provide concrete coverage in accordance with ACI 318.

G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and end of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

H. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
   2. Stagger splices in accordance with ACI 318.

3.7 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.
   3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

   1. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.

4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.8 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete in accordance with ACI 224 and with approval of Architect.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

   a. Continue reinforcement across construction joints unless otherwise indicated.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.9 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

   a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
   b. Remove projections larger than 1 inch.
   c. Tie holes do not require patching.
   d. Surface Tolerance: ACI 117, Class D.
   e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

   a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   b. Remove projections larger than 1/4 inch.
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117, Class B.
   e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 APPLICATION OF FINISHING FLOORS AND SLABS

A. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Typical floor unless otherwise listed.
            a) SO FF 25/FL 20 with MLFF 17/MLFL 15.
        2) Thin-set flooring and warehouse floor.
            a) SO FF 35/FL 25 with MLFF 21/MLFL 13.

D. Trowel and Fine-Broom Finish: First apply a trowel finish to surfaces indicated on Drawings or where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.11 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: As indicated on Drawings.
4. Install dowel rods to connect concrete base to concrete floor.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

   a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Cast anchor-bolt insert into bases.
   c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.

2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

   a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
   b. Continuous Sprinkling: Maintain concrete surface continuously wet.
   c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing after finishing concrete.

2. Interior Concrete Floors: Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
   a. Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      1) Lap edges and ends of absorptive cover not less than 12 inches.
      2) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
   b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      1) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      2) Cure for not less than seven days.
   c. Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
      1) Water.
      2) Continuous water-fog spray.

3. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
   a. Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      1) Lap edges and ends of absorptive cover not less than 12 inches.
      2) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
   b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      1) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      2) Cure for not less than seven days.
   c. Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      1) Water.
      2) Continuous water-fog spray.

4. Floors to Receive Polished Finish: Contractor has option of the following:
   a. Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      1) Lap edges and ends of absorptive cover not less than 12 inches.
      2) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
   b. Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      1) Water.
      2) Continuous water-fog spray.

5. Floors To Receive Chemical Stain:
   a. As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
   b. Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
   c. Butt sides of curing paper tight; do not overlap sides of curing paper.
   d. Leave curing paper in place for duration of curing period, but not less than 28 days.

6. Floors To Receive Urethane Flooring:
   a. As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   b. Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
   c. Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.

d. Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

7. Floors To Receive Curing Compound:
   a. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   b. Recoat areas subjected to heavy rainfall within three hours after initial application.
   c. Maintain continuity of coating, and repair damage during curing period.
   d. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

8. Floors To Receive Curing and Sealing Compound:
   a. Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   b. Recoat areas subjected to heavy rainfall within three hours after initial application.
   c. Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.13 TOLERANCES

A. Conform to ACI 117.

3.14 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
   3. Rinse with water; remove excess material until surface is dry.
   4. Apply a second coat in a similar manner if surface has received a float finish or abrasive surface preparation.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.15 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

   1. Defer joint filling until concrete has aged at least six month(s).

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
        13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.

C. Delivery Tickets: comply with ASTM C94.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C172 to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143:

   a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

3. Slump Flow: ASTM C1611:

   a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

4. Air Content: ASTM C231 pressure method, for normal-weight concrete

   a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample when strength test specimens are cast.

6. Concrete Density: ASTM C138:

   a. One test for each composite sample when strength test specimens are cast.

7. Compression Test Specimens: ASTM C31:

    a. Cast and standard cure two sets of two 6 inches by 12-inches or 4-inch by 8-inch cylindrical specimens for each composite sample.
    b. Cast, and field cure two sets of two standard cylindrical specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39.

    a. Test one set of two standard cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.17 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

END OF SECTION 033000

SECTION 033543
DIAMOND POLISHING CONCRETE FLOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Products and procedures for diamond polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

B. Related Requirements

1. Section 033000 Cast-In-Place Concrete.

1.2 DEFINITIONS

A. Terminology: As defined by CPAA.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.

C. Field Quality Control – Static Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman or Master Craftsman by CPAA.
3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

B. Walkway Auditor: Certified by NFSI to test polished floors for static coefficient of friction according to NFSI 101-A.

C. Static Coefficient of Friction: Achieve not less than 0.5 for level floor surfaces as determined by quality control testing according to NFSI 101-A.

D. Field Mock-up for Aesthetic Purposes: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

1. Grind, hone, and polish 12 ft. square floor area for each finish approved under sample submittals; include edges and joints.
2. Use same personnel, including supervisors, which will perform work.
3. Install products and materials according to specified requirements.
4. Work shall be representative of those to be expected for work.
5. Finish various components to show maximum variation that will exist in work.
6. Approval is for following aesthetic qualities:

    a. Compliance with approved submittals.
    b. Uniformity of exposed aggregate.
    c. Uniformity of sheen.

7. Obtain Architect's approval before starting work on Project.
8. Protect approved field mock-ups from elements with weather resistant covering.
9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect.

E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

    a. Owner.
    b. Architect.
    c. Contractor, including supervisor.
    d. Concrete producer.
    e. Concrete finisher, including supervisor.
    f. Concrete polisher, including supervisor.
    g. Technical representative of liquid applied product manufacturers.
    h. Walkway auditor.

2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:

a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
b. Review Contract Document requirements.
c. Review approved submittals.

d. Review procedures, including, but not limited to:

1) Details of each step of grinding, honing, and polishing operations.
2) Application of liquid applied products.
3) Protecting concrete floor surfaces until polishing work begins.
4) Protecting polished concrete floors after polishing work is completed.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 FLATNESS AND LEVELNESS OF POLISHED CONCRETE FLOOR

A. Concrete Floor Flatness: 45

B. Concrete Floor Levelness: 40

1.6 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.

1. Prohibit vehicle parking over concrete surfaces to be polished.
2. Prohibit pipe cutting operations over concrete surfaces to be polished.
3. Prohibit storage of any items over concrete surfaces to be polished for not less than 28 days after concrete placement.
4. Prohibit ferrous metals storage over concrete surfaces to be polished.
5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
7. Protect from painting activities over concrete surfaces to be polished.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.

1. Approved Manufacturers:

a. Retro-Plate 99, manufactured by Advanced Floor Products, Inc. or approved equal P.O. Box 50533, Provo, Utah 1-801-812-3420. Regional Representative, The Budd Group 1-248-649-5727.
b. BASF Corporation; Construction Systems.
c. Brickform; a division of Solomon Colors.
d. Hoover Color Corporation.
e. Matcrete Inc.
f. Rockwood Pigments NA, Inc.
g. Scofield, L.M. Company.
h. Specialty Concrete Products, Inc.

2. Colors:

a. PC – Salt and Pepper polished concrete product.
b. ST.C-1 – Blue integral color with pigment concentration.
c. ST.C-2 – Bright Blue integral color with pigment concentration.
d. ST.C-3 – Orange integral color with pigment concentration.
e. ST.C-4 – Purple integral color with pigment concentration.

3. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

a. Retro-Guard, manufactured by Advanced Floor Products, Inc. or approved equal.
b. BASF Corporation; Construction Systems.
c. Brickform; a division of Solomon Colors.
d. Hoover Color Corporation.
e. Matcrete Inc.
f. Rockwood Pigments NA, Inc.
g. Scofield, L.M. Company.
h. Specialty Concrete Products, Inc.

B. Product Warranty

1. Applicator shall warrant the concrete surface for a period of 10 years. The surface shall remain hardened, dustproof and water-repellant.

2.2 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.3 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.

2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning New Concrete Surfaces:

1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 VAPOR TESTING CONCRETE FLOORS

A. Alkalinity:

1. Test Method: Measure pH according to method indicated in ASTM F 710.
2. Acceptable Results: pH between 8 and 10.

B. Moisture Vapor Transmission Rate:

1. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
2. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

C. Relative Humidity:

1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
2. Acceptable Results: Not more than 75 percent.

3.4 POLISHING CONCRETE FLOORS

A. Sequence of Polishing: Perform polishing after partition studs are erected, but before gypsum board is installed.

B. Initial Grinding:

1. Use grinding equipment with metal bonded grinding pads.
2. Begin grinding in one direction using sufficient size grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Vacuum floor using squeegee vacuum attachment after each pass.
6. Continue grinding until aggregate exposure matches approved field mock-ups.

C. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturers instructions.

E. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.
2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

F. Honing:

1. Use grinding equipment with resin bonded grinding pads.
2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

G. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.
2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 1500 grit.

4. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit in corridors only.
5. Achieve maximum refinement with each pass before proceeding to finer grit pads.
6. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
7. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

H. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

I. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

J. Final Polished Concrete Floor Finish:

1. Aggregate Exposure: Class B – Fine Aggregate (Commonly called: Salt/Pepper Finish) 85-95% fine aggregate; 5-15 % blend of fines and coarse aggregate.

2. Reflective Clarity and Reflective Sheen: Level 3, Semi-Polished Appearance, as defined by CPAA:

a. Procedure: Not less than 6 steps with full refinement of each diamond pad up to 1500 grit resin bonded pad with one application of densifier.
b. Gloss Reading: Not less than 60 according to ASTM E 430 before polish guard application.

3.5 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing according to NFSI 101-A to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.6 CLOSEOUT ACTIVITIES

A. Maintenance Training: CPAA Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.7 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION 033543

SECTION 035113 - CEMENTITIOUS WOOD FIBER DECKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cementitious wood-fiber plank units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include details at supports, reinforcement at openings, and attachment to other work.

C. Samples: Show texture, finish, and edge and end configurations of each type of cementitious wood-fiber unit, 24 inches long by width of unit.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For cementitious wood-fiber units, for tests performed by a qualified testing agency.

B. Evaluation Reports: For cementitious wood-fiber deck, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cementitious wood-fiber units from moisture.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Provide labels indicating brand name, deck style, plank size and plank thickness.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Prevent soiling, physical damage or wetting.
2. Store cartons open at each end to stabilize moisture content and temperature.
3. Store units on elevated platforms at Project site in a dry, well-ventilated, covered space and stack according to manufacturer's written instructions.
4. Handle units to prevent chipping, breaking, cracking, staining, soiling, warping, or other physical damage. Discard damaged units at time of installation.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturers' written instructions and warranty requirements.

B. Protect cementitious wood-fiber deck from moisture during installation and while exposed to the weather until permanently covered with subsequent construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide a roof deck system that has been manufactured, fabricated, and installed to provide deflection less than L/360 total live load and L/240 at total design load (dead + live).

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Noise Reduction Coefficient (NRC): NRC 0.60; ASTM C423.

E. Light Reflectance: 60 percent; ASTM E1349.

2.2 CEMENTITIOUS WOOD-FIBER PLANK UNITS

A. Monolithic Plank: Manufacturer's standard, tongue-and-groove-edged, cementitious wood-fiber units.

1. Manufacturer: Tectum
2. Thickness: 7 inches (Type E-N Roof Plank).
3. Size: Manufacturer's standard width; length to span a minimum of three supports.
4. End Configuration: Square.
5. Finish: Manufacturer's standard natural or prime-painted finish.

2.3 ACCESSORIES

A. Anchor Clips: Manufacturer's standard formed anchor clips of 0.0478-inch-thick minimum, galvanized-steel sheet, of type and configuration required for deck system indicated.

B. Screws: Manufacturer's recommended corrosion-resistant screw fasteners and washers, self-drilling, self-tapping, of length required for deck and structural framing indicated.

C. Low VOC Adhesive: Manufacturer's recommended construction adhesive complying with APA AFG-01.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structural support framing for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing cementitious wood-fiber deck.

1. Stagger lay-up.
2. Install fastenings according to manufacturer's written instructions unless otherwise indicated.

B. Deck Interruptions: Provide barrier seals or blocking at overhangs to form wind seals and at partitions and walls to form sound seals unless otherwise indicated.

3.3 ROOF DECK INSTALLATION

A. Plank Roof Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.

1. Cut panels to provide starter units.
2. Continuously support plank edges and ends at perimeter of building and at openings in deck.
3. Mechanically fasten planks to supports and perimeter members.
4. Adhesively and mechanically fasten planks to supports and perimeter members. Apply adhesive to tongue-and-groove edges.

3.4 FORM-DECK INSTALLATION

A. Plank Form Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.

1. Cut panels to provide starter units.
2. Continuously support plank edges and ends at perimeter of building and at openings in deck.

3.5 CLEANING AND PROTECTION

A. Protect top surfaces of deck from damage caused by construction operations.

B. Protect exposed bottom surfaces of deck from soiling and damage during handling and construction.

C. Clean exposed bottom surfaces of completed deck and touch up minor damage to surfaces as approved by Architect.

D. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that cementitious wood-fiber deck is without damage or deterioration at time of Substantial Completion.

E. Remove and replace deteriorated and damaged deck units.

END OF SECTION 035113

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Brick.
3. Mortar and grout materials.
4. Mortar and grout mixes.
5. Reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Stone trim units in unit masonry.
3. Steel lintels in unit masonry.
4. Steel shelf angles for supporting unit masonry.
5. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 072100 "Thermal Insulation" for cavity wall insulation.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
3. Section 089516 "Wall Vents" for wall vents (brick vents).

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Standard CMU.
2. Decorative CMU.
3. Glazed brick.
4. Colored mortar.
5. Weep/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Standard CMU.
2. Decorative CMU.
3. Glazed brick.
4. Special brick shapes.
5. Weep/cavity vents.
6. Cavity drainage material.
7. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

c. For exposed brick, include test report for efflorescence in accordance with ASTM C67.
d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Qualification Statements: For testing agency.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109 for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
2. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 MOCKUPS

A. Wall Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as directed by Architect.
2. Build mockups for typical exterior wall in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories, or larger as required to show all stone and masonry materials in wall assembly.

    a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    c. Include metal studs, sheathing, water-resistive barrier, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joists; and aesthetic qualities of workmanship.
    a. Approval of mockups is also for other material and construction qualities specifically approved by architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations by Change Order.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C90, normal weight.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs: ASTM C90, normal weight.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.
2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
3. Pattern and Texture: Standard pattern, ground-face finish.
4. Colors: As selected by Architect from manufacturer's full range.
   a. Basis of Design: Grand Blanc Cement; “Light Gray”
5. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

B. Glazed Brick: Facing brick complying with ASTM C216, with glaze complying with ASTM C126; Grade SW or Type FBS.
1. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and provide Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
2. Application: Use where brick is exposed unless otherwise indicated.
3. Colors: As selected by Architect from manufacturer's full range.
a. Basis of Design: Belden; “Eggplant”, “Keywest”, “Pumpkin Patch”, and “Starry Night”.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91.

E. Mortar Cement: ASTM C1329.

F. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, masonry cement, or mortar cement, sand, and admixtures and complying with ASTM C1714.

G. Aggregate for Mortar: ASTM C144.

H. Aggregate for Grout: ASTM C404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C or ASTM C1384, and recommended by manufacturer for use in masonry mortar of composition indicated.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

K. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615 or ASTM A996, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064, with ASTM A153, Class B-2 coating.
2. Stainless Steel Wire: ASTM A580, Type 304 or Type 316.

3. Galvanized-Steel Sheet: ASTM A653, Commercial Steel, G60 zinc coating.
4. Steel Sheet, Galvanized after Fabrication: ASTM A1008, Commercial Steel, with ASTM A153, Class B coating.
5. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304 or Type 316.
6. Steel Plates, Shapes, and Bars: ASTM A36.
7. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel.

D. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
3. Provide anchorage system consisting of single barrel screw and looped wire ties.

2.7 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240 or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7 oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
   a. Accessories: Provide preformed corners, and dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Applications: Unless otherwise indicated:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge metal flashing or flexible flashing.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn96, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch.

2.8 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vents: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:
   a. Strips, not less than 1-1/2 inches thick and 10 inches high, with dovetail-shaped notches 7 inches deep designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion or Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For concrete masonry above grade, use Type S.
3. For brick masonry above grade, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs and glazed brick as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and glazed brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set stone and cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Rake out mortar joints at glazed brick to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and air barriers unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 24 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.

3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches.
3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

E. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 12.67 ft.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Michigan Building Code and TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
2. Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for painting requirements.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

B. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1 for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Survey of existing conditions.

F. Source quality-control reports.

G. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1, Endorsement P2, Endorsement P3, or to SSPC-QP 3.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992 or ASTM A572, Grade 50.

B. Channels, Angles, M-Shapes: ASTM A36

C. Plate and Bar: ASTM A36

D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade C.

E. Steel Pipe: ASTM A53, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36 carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Plain.

B. Threaded Rods: ASTM A36

1. Nuts: ASTM A63 heavy-hex carbon steel.
2. Washers: ASTM A36 carbon steel.
3. Finish: Plain.

2.5 PRIMER

A. Steel Primer:

1. Comply with Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6 and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

F. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Corrosion-resisting (weathering) steel surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780.

B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099123 "Interior Painting." And Section 099600 "High-Performance Coatings."

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. LH-series long-span steel joists.
2. Steel joist accessories.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
2. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and professional engineer.

B. Welding certificates.

C. Manufacturer certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Mill Certificates: For each type of bolt.

F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:

a. Roof Joists: Vertical deflection of 1/360 of the span.

2.2 STEEL JOISTS

A. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.

1. Joist Type: LH-series long-span steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: As indicated on Drawings..
4. Provide holes in chord members for connecting and securing other construction to joists.
5. Camber long-span steel joists according to SJI's "Specifications."
6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

2.4 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
2. Schematically indicated. Detail and fabricate according to SJI's "Specifications.” Furnish additional erection bridging if required for stability.
3. Fabricate as indicated on Drawings and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36 steel with integral anchorages of sizes and thicknesses indicated on Drawings.

C. Steel bearing plates with integral anchorages.

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

F. Welding Electrodes: Comply with AWS standards.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

   a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   b. Apply a compatible primer of same type as primer used on adjacent surfaces.

2. Cleaning and touchup painting are specified in Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1.
2. AWS D1.3.

B. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and windstorm ratings. Identify materials with FM Approvals Certification markings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

A. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: Manufacturer's standard.

2. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Grade 3, G90 zinc coating.
3. Deck Profile: As indicated
4. Profile Depth: As indicated
5. Design Uncoated-Steel Thickness: As indicated

6. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated
7. Span Condition: As indicated
8. Side Laps: Overlapped.

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and [level] [sloped] recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A780, SSPC-Paint 20, or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one [weld] [fastener] at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780 and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on [both surfaces] [top surface] of prime-painted deck immediately after installation, and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Double deflection track.
8. Drift clips.
9. Ceiling joist framing.
10. Soffit framing.
11. Post-installed anchors.
12. Power-actuated anchors.
13. Sill sealer gasket.
14. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association, or the Supreme Steel Framing System Association.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height.
   b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
   d. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
   e. Roof Rafter Framing: Vertical deflection of 1/360 of the horizontally projected span for live loads.
   f. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 3/4 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100, AISI S200, AISI S240, and ASTM C955.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S100, AISI S200, AISI S240, and ASTM C955 for conditions indicated.

B. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

   1. Grade: As required by structural performance.
   2. Coating: G60 or equivalent.

C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1-5/8 inches.
3. Section Properties: As required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1-1/4 inches.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Minimum Depth: 6 inches.
3. Flange Width: 1-5/8 inches.
4. Section Properties: As required by structural performance.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 33 mils (0.0329 inch).
2. Flange Width: 1-5/8 inches.
3. Section Properties: As required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1 inch plus the design gap for one-story structures.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
b. Flange Width: 1 inch plus the design gap for one-story structures.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 33 mils (0.0329 inch).
2. Flange Width: 1-5/8 inches.
3. Section Properties: As required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 33 mils (0.0329 inch).
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1 inch plus the design gap for one-story structures.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
b. Flange Width: 1 inch plus the design gap for one-story structures.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: As required by structural performance.

2.7 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, punched with standard holes, or punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 33 mils (0.0329 inch).
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: As required by structural performance.

2.8 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 33 mils (0.0329 inch).
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: As required by structural performance.

2.9 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by[hot-dip process according to ASTM A153, Class C or mechanically deposition according to ASTM B695, Class 50.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or adhesive anchor.

3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.11 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780, MIL-P-21035B, or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
1. Physical Properties:

a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
b. Low-Temperature Flexibility: Pass at minus 25 deg F when tested in accordance with ASTM D146.
c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96, Method B.
d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.12 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop fabricated ("panelized") for field installation, or it may be field assembled ("stick-built").

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire

integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.

1. Fasten both flanges of studs to top and bottom tracks.
2. Space studs as follows:

a. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.

4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Shop Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.7 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

D. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

E. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.8 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 054400 - COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-formed steel roof trusses.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Cold-formed steel roof trusses.

B. Product Data Submittals:

1. Cold-formed steel truss materials.
2. Anchor bolts.
3. Post-installed anchors.
4. Power-actuated fasteners.
5. Mechanical fasteners.

C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. Delegated Design Submittals: For cold-formed steel trusses.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel trusses.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
   a. Roof Trusses: Vertical deflection of 1/360 of the span.
   b. Monoslope Roof Trusses: Horizontal deflection of 1 inch.

3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses comply with AISI S213 and AISI S214.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.

2. Coating: G90 or equivalent.

2.3 COLD-FORMED STEEL ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard C-shaped steel sections.

1. Minimum Base-Metal Thickness: 43 mils (0.0428 inch).
2. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
3. Section Properties: As required by structural performance.

2.4 TRUSS ACCESSORIES

A. Fabricate steel-truss accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.

B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated, as follows:

1. Supplemental framing.
2. Bracing, bridging, and blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Joist hangers and end closures.
9. Hole-reinforcing plates.
10. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process in accordance with ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process in accordance with ASTM A153, Class C or mechanically deposition according to ASTM B695, Class 50.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel trusses to structure.

2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780, MIL-P-21035B, or SSPC-Paint 20.

B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.7 FABRICATION OF COLD-FORMED STEEL TRUSSES AND ACCESSORIES

A. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate trusses using jigs or templates.
2. Cut truss members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual truss members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting trusses and framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COLD-FORMED STEEL TRUSSES

A. Install bridge, and brace cold-formed steel trusses in accordance with AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.

1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
2. Anchor trusses securely at all bearing points.
3. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses.".

B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.

1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
2. Erect trusses without damaging truss members or connections.
3. Fasten cold-formed steel trusses by welding or mechanical fasteners.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.

D. Truss Spacing: As indicated on Drawings.

E. Do not alter, cut, or remove truss members or connections of trusses.

3.3 ERECTION TOLERANCES

A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint in accordance with ASTM A780 and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Cold-Formed Steel Trusses Spanning 60 Feet or Longer: Verify temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed according to the approved truss submittal package.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal ladders
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
5. Loose steel lintels.
6. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
7. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

B. Related Sections:
1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg. F ambient; 180 deg. F material surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS

A. General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
   3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
   4. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
      a. Size of Channels: as required for strength.
      b. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33ith G90ating; 0.079-inchminal thickness.
   5. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941lass Fe/Zn 5, at exterior walls.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941lass Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
   1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
   2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   3. Form exposed work with accurate angles and surfaces and straight edges.
   4. Weld corners and seams continuously to comply with the following:
      a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      b. Obtain fusion without undercut or overlap.
      c. Remove welding flux immediately.
      d. At exposed connections, finish exposed welds and surfaces smooth and blended.
   5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
   6. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
   7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
   8. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

a. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
3. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
4. Galvanize shelf angles located in exterior walls.
5. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

D. Metal Ladders: Provide steel roof access ladder in compliance with ANSI A14.3.
1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: continuous, 1/2 by 2-1/2 inch steel flat bars, with eased edges.
3. Rungs: 3/4 inch diameter, steel bars.
4. Prime ladders, including brackets.

E. Miscellaneous Steel Trim: Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
2. Galvanize exterior miscellaneous steel trim.

F. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
1. Finish: Leave unfinished.

G. Steel Lintels: Fabricate steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
1. Size lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
2. Galvanize steel lintels located in exterior walls.

H. Steel Weld Plates and Angles: Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.
1. Finish: Leave unfinished.

2.5 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish metal fabrications after assembly.
   2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Steel And Iron Finishes:
   1. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   2. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
      a. Shop prime with primers specified in Division 09 painting Sections unless zinc-rich primer is indicated.
   3. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
   1. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
   2. Field Welding: Comply with the following requirements:
      a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      b. Obtain fusion without undercut or overlap.
      c. Remove welding flux immediately.
      d. At exposed connections, finish exposed welds and surfaces smooth and blended.
   3. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
   4. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Installing Miscellaneous Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

C. Installing Bearing and Leveling Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
   1. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove

wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061053
MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.

B. Related Sections include the following:

1. Division 9 Section "Interior Painting" for items to be painted.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Material Compliance Certificate: Submit completed Material Compliance Certificate as described in Specification Section 013300 – Architect's Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

1. Western woods; WCLIB or WWPA.
2. Northern species; NLGA.
3. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Eastern softwoods, No. 2 Common grade; NELMA.
2. Northern species, No. 2 Common grade; NLGA.
3. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel..

B. Power-Driven Fasteners: NES NER-272.

C. Wood Screws: ASME B18.6.1.

D. Lag Bolts: ASME B18.2.1.

E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

2.8 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

2.9 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.

2.10 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Parapet sheathing.
2. Sheathing in contact with roofing membrane.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

D. Application: Treat all plywood unless otherwise indicated.

2.5 WALL SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, sheathing.

C. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

2.6 PARAPET SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch thick.
2. Size: 48 by 96 inches for vertical installation.

C. Glass-Mat Roof Sheathing:

1. Wall Sheathing at Walls with Vertical Applications of Roofing Membrane:

a. Pre-primed glass mat reinforced water-resistant gypsum board, 5/8" thick, complying with ASTM C 1177. Equal to Dens-deck "Prime" by Georgia Pacific Corporation. Product type acceptable to the roofing membrane manufacturer.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION 061600

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.
5. Vapor retarders.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
2. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.3 SUBMITTALS

A. Material Compliance Certificate: Submit completed Material Compliance Certificate as described in Specification Section 013300 – Architect's Submittal Procedures".

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The).
b. Owens Corning.

2. Type VI, 40 psi.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84, passing ASTM E 136 for combustion characteristics.

1. Nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.

D. Sustainability Requirements: Provide glass-fiber board insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Nominal density of 6 lb/cu. ft., Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fiber Color: Darkened, where indicated.

2.5 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Staples.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.6 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

3.4 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072119
FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 75 or less.
   b. Smoke-Developed Index: 450 or less.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Cavity Walls: Install into cavities to 3” or thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072500
WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wrap.
2. Flexible flashing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
2. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.

3. Allowable UV Exposure Time: Not less than three months.
4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.

1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of continuous insulation board or sheathing where insulation is not required, with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover insulation board with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.

2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 074200
PREFABRICATED WALL PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

1. Section 054000: Cold Formed Metal Framing (used for other work)
2. Section 061600: Sheathing (used for other work)
3. Section 072100: Thermal Insulation
4. Section 074213.13: Formed Metal Wall Panels
5. Section 076200: Sheet Metal Flashing and Trim
6. Section 079200: Joint Sealants
7. Section 084113: Aluminum Framed Entrances and Storefront Systems

1.2 SUMMARY

A. Basis of Design: Sto Panel Back-up Wall Assembly

1. Provide pre-fabricated, structural, exterior backup wall panels with integral StoGuard air and moisture barrier for exterior above grade walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, sto panel Installer, sto panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects sto panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to sto panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for sto panel assembly during and after installation.
7. Review of procedures for repair of sto panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Submit the following:

1. Component manufacturer's product data.

2. Shop drawings for each panel and for project-specific details.
   a. Detail configurations of panelized units.
   b. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
   c. Indicate details at building corners.
   d. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and in-panel hardware and connections.
   e. Indicate locations and details of anchorage devices to be embedded in or attached to structure or other construction.
   f. Include plans and elevations showing unit location and sequence of erection for special conditions.
   g. Indicate location of each panelized unit by same identification mark placed on panel.
   h. Indicate relationship of panelized units to adjacent materials.

1.5 INFORMATIONAL SUBMITTALS

A. Submit the following.
1. Component manufacturer’s code compliance report.
2. Affiliate’s Sto Panel Technology affiliate certificate.
3. Calculations: Provide structural calculations prepared in compliance with these specifications. Where these specifications and code differ, more severe requirements shall govern. Test reports are not an acceptable substitute for calculations. Calculations shall include the following information:
   a. Analysis for all applicable loads on framing members and attachment hardware.
   b. Seal and signature on calculations of professional structural engineer currently registered in State in which the project is located.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Manufacturer’s recommendations for cleaning and repairing damage to system.

B. Component manufacturer’s standard warranty.

1.7 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. StoPanel fabricator/installer shall be an Affiliate in good standing with Sto Panel Technology.
   2. Sto Panel Technology Affiliate shall fabricate and install the StoPanel panels in accordance with Sto Panel Technology Fabrication and Installation Quality Standards.

B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with Sto Panel Technology Fabrication and Installation Quality Standards.'

C. Inspections
   1. Provide independent third party inspection of completed StoPanel panel installation, where required by code or contract documents.
   2. Conduct inspections in accordance with code requirements and Contract Documents.

D. Mock-up Testing
   1. Construct full-scale mock-up of typical panel assembly with specified tools and materials incorporating windows, doors and other penetrations, as depicted in Contract Documents.
   2. Test air and water infiltration and structural performance in accordance with ASTM E283, E331 and E330, respectively, through an independent laboratory.
   3. Mock-up shall comply with Design Team requirements.
   4. Acceptable mock-up may remain as part of project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels to site reserved and secured trailer staging area in sequence of erection and according to scheduled dates.

B. If panels are stored on site, provide protection of panels from weather and damage.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

B. General Contractor shall provide restricted, level and stabilized staging and truck/crane operating area for the exclusive use of the panel installation operation, in accordance with OSHA standards for Steel Erection. (See 29 CFR 1926, Subpart R—Steel Erection, Section 1926.752(c)).

C. All project general conditions safety measures (perimeter fall protection, stairs, hole covers, rebar capping, site grading, etc.) shall be coordinated by the General Contractor and installed and maintained by others prior to the panel installation forces mobilizing on site. All such measures shall allow for the required access of panel installation forces and processes and shall be configured such that panel installation can be completed without the modification or removal

of such measures. All such measures shall be removed and/or modified by others at the direction of the General Contractor after the completion of panel installation and the General Contractor has determined that they are no longer needed.

D. General Contractor shall provide all project general conditions items and services (water, power, general lighting, sanitary facilities, dumpster, restricted jobsite, etc.).

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MANUFACTURERS

A. Basis of Design: Backup wall panel system shall be fabricated by a Sto Panel Technology Affiliate.

B. Air/moisture barrier and ci components shall be manufactured or recognized for use in the wall panel assembly by Sto Corp.

C. Acceptable Fabricators: Subject to compliance with requirements of Sto Panel Technology. For a list of acceptable fabricators visit www.stopanel.com.

2.2 PERFORMANCE REQUIREMENTS

A. Sto Panel Technology Affiliate shall fabricate the StoPanel Backup panels using materials shown to meet or exceed the following performance requirements.

Table 1—Air and Moisture Barrier Physical Performance

TEST	METHOD	CRITERIA	RESULTS
1. Water Penetration Resistance	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	Pass
2. Water Penetration Resistance after Cyclic Wind Loading	ASTM E1233 / ASTM E331	No water at exterior plane of sheathing after 10 cycles @ 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) differential	No water penetration
3. Water Resistance Testing	ASTM D2247	Absence of deleterious effects after 14 day exposure	No deleterious effects
4. Water Vapor Transmission	ASTM E96 Method B (Water Method)	Measure	Sto Gold Fill®: 7.10 perms [408 ng/(Pa·s·m2)] Sto Gold Coat®: > 10 perms [574 ng/(Pa·s·m2)]
5. Air Leakage	ASTM E2178	$\leq$ 0.004 cfm/ft^2 at 1.57 psf (0.02 L/s•m^2 at 75 Pa)	Pass
6. Structural Integrity	ASTM E330	2-inches (51 mm) H_2O pressure (positive & negative) for 1 hour.	Pass
7.. Tensile Adhesion	ASTM C297	>15 psi (103 kPa)	Gypsum Sheathing (ASTMC 1177): >30 psi (207 kPa)

* Note: Sto Gold Fill testing with Sto Detail Mesh reinforcement

Table 2—Air and Moisture Barrier Fire Performance

TEST	METHOD	CRITERIA	RESULT
1. Surface Burning	ASTM E84	Flame Spread 0 – 25 for NFPA Class A, UBC Class I	Flame Spread: 5 Smoke Density: 10
2. Fire Endurance	ASTM E 119	Maintain fire resistance of existing rated assembly	Pass*

3. Intermediate Scale Multi-Story Fire Test	NFPA 285 (UBC Standard 26-9)	1. Resistance to vertical spread of flame within the core of the panel from one story to the next 2. Resistance to flame propagation over the exterior surface 3. Resistance to vertical spread of flame over the interior surface from one story to the next 4. Resistance to significant lateral spread of flame from the compartment of fire origin to adjacent spaces	Pass (see ICC-ESR 1233)
4. Radiant Heat Ignition	NFPA 268	No ignition @ 20 minutes	Pass (see ICC-ESR 1233)

Note: * indicates results based on extrapolation of data from testing.

B. Energy Standards Compliance: Wall panel system shall comply with the requirements of ASHRAE 90.1 - 2010 and 2013 for:

1. Section 5: Continuous Air Barrier

2.3 DESIGN CRITERIA

A. Sto Panel Technology Affiliate shall engage a qualified professional structural engineer, licensed in the state in which the project is located, to provide structural calculations:

1. Acknowledging the applicable Code design parameter values.
2. Acknowledging the loading applied to the panels (including transferred window loads, etc.).
3. Substantiating the detailed panel framing and connection hardware.
4. Providing the loads transferred to the supporting building structure, for submission to the Design Team and the Project Engineer of Record.

B. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100, AISI S200 and AISI S211.

C. Incorporate provisions within the structural calculations for the StoPanel wall panel system to provide for expected movement of structural members, as determined by structural engineer of record, without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects. Incorporate provisions for panels to allow for movement of adjacent framing members outside the insulated building envelope, when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

D. Wind Load

1. Incorporate provisions within the structural calculations for the StoPanel wall panels for maximum allowable system deflection, normal to the plane of the wall, as required for

specified follow-up construction (L/240 maximum). Adjust allowable deflection requirement for more stringent deflection requirements where required by code or specific finish requirements.

2. Provide for wind load resistance in conformance with code requirements and as agreed to with the Project Design Team.

E. Moisture Control: Fabricate panels to restrict air infiltration into the panel assembly to limits determined by applicable ASHRAE 90.1 requirements.

F. Joints:

1. Provide panels with allowance for minimum nominal 3/4 inch (19 mm) wide joints between panels and adjacent to other work.
2. Provide panels with allowance for minimum nominal 3/4 inch (19 mm) wide perimeter shim spaces and sealant joints at penetrations through the pre-fabricated panel assembly (windows, doors, etc.).
3. Panel Joint Filler (Provided by others): Unless otherwise noted by design team, provide joint design including sealants and backer rods specified in Joint Sealants section that comply with the following requirements:
   a. One part low modulus silicone sealant conforming to ASTM C920
   b. Maintain air barrier continuity across the joint.
   c. Use double seals or other approved redundant joint sealant configuration.
   d. Use sealant/primer combinations compatible with the materials on both sides of the sealant joints.

G. Grade Condition: Panels shall not be installed below grade or where panel surfaces are subject to continuous or intermittent water immersion or hydrostatic pressure. Provide minimum 6 inch (152 mm) clearance above finished grade or as required by code.

H. Fire Protection:

1. Field application of additional fire resistant materials (such as interior gypsum wallboard) are typically required to be added to the installed panels (by others) to provide the finished fire-resistant and building code compliant assembly.

2.4 FABRICATION

A. Fabricate all StoPanel panels and connection hardware in accordance with shop drawings and Sto Panel Technology Fabrication and Installation Quality Standards.

B. Product Tolerances: Fabricate panelized units to shapes, lines, and dimensions indicated in accordance with Sto Panel Technology Fabrication and Installation Quality Standards and the following dimensional tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View:
   a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
   b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
   c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
   d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
2. Total Thickness at Perimeter: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).

3. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches (3 mm/1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
4. Length and Width of Openings within One Unit: Plus or minus 1/4 inch (6 mm).
5. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
6. Warping: 1/16 inch/12 inches (1.5 mm/300 mm) of distance from nearest adjacent corner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Upon mobilization onto the project site, examine building supporting structural frame elements and adjacent conditions for compliance with requirements for proper panel installation, in accordance with approved panel shop drawings. Check bearing and adjacent surface locations and other conditions affecting installation of the panels.

B. Do not proceed with wall panel installation until General Contractor confirms that the structure is structurally ready to receive loads from panel units and preceding trades' work is complete and corrected.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Layout: Layout for installation of panels from control lines and bench marks provided by General Contractor.

1. Install sufficient layout markings to install panels as per approved shop drawings and Sto Panel Technology Fabrication and Installation Quality Standards.
2. Install clips, plates, and other accessories required for connecting wall panels to supporting structure.
3. Re-check preceding trade work for compliance of proper and complete panel installation, as per approved shop drawings.
4. Do not deviate from the approved panel shop drawing layout. Deviate only as directed by and agreed to with the General Contractor.

B. Erection: Erect panels level, plumb, and square within specified allowable tolerances in accordance with approved shop drawings:
1. Erect panels from trailers or staging stacks onto the building, in the agreed to sequence, to approximate line and grade as established in the layout phase.
2. Maintain approximate horizontal and vertical joint alignment and approximate uniform joint width as erection proceeds.
3. Install a sufficient number of permanent and/or temporary connections as required to maintain stability of the panels until panels are tuned-up and all permanent connections are completed.
4. Install temporary shims and/or erecting aids as necessary as panels are being erected.
5. Return reusable dunnage to fabrication plant on unloaded panel delivery trailers.
6. Deposit trash and waste into dumpsters as provided by the General Contractor.

C. Tune-up: Adjust and final connect wall panels in position by bolting, welding, or as otherwise indicated on shop drawings and in accordance with Sto Panel Technology Fabrication and Installation Quality Standards.
   1. Adjust panel locations as necessary to maintain final panel positions within tolerances.
   2. Install balance of permanent connections.
   3. Remove temporary shims and/or erecting aids after panel connections are completed.
   4. Notify General Contractor of completed panel tune-up progress and request a review of tuned-up panels and release for follow-up trade work.

D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.3/D1.3M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

E. Tolerances: Install panels level, plumb, square, and in alignment without exceeding the erection tolerances of Sto Panel Technology Fabrication and Installation Quality Standards and the following:
   1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
   2. Top Elevation from Nominal Top Elevation: As follows:
      a. Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
      b. Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
   3. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
   4. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
   5. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
   6. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch (6 mm).
   7. Maximum Joint Taper: 3/8 inch (10 mm).
   8. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).
   9. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).
   10. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).
   11. Opening Height between Spandrel Panels: Plus or minus 1/4 inch (6 mm).

3.3 CLEANING AND PROTECTION

A. Coordinate follow-up trades and follow-up work to proceed in such a way to protect installed panels from water infiltration into or behind panels.

B. Replace pre-fabricated panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074200

SECTION 074213.13
FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed fastener metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized Installer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 1-1/2-inch per foot (1:8) of all required trim and extrusions needed for a complete installation.

1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.

C. Samples for Initial Selection: For each product specified. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 MOCKUPS

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Construct a full-scale mock-up of typical panel assembly with specified tools and materials incorporating pre-fabricated backup panel per Specification 074263.13, windows, doors and other penetrations, as depicted in the Contract Documents.
2. Mock-up shall comply with Design Team requirements.
3. Acceptable mock-up may remain as part of project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 EXPOSED FASTENER METAL WALL PANELS

A. General: Single-skin exposed fastener metal wall panels applied as exterior rainscreen cladding over pre-fabricated wall framing specified in Division 07 Section "Sto-Panel Backup" with exterior sheathing, an applied membrane that provides air, moisture, and water vapor control, and insulation within the framing and applied outboard of the sheathing specified in Division 07 Section "Thermal Insulation." Metal wall panel installation specified in this Section includes secondary metal subgirt framing for panel attachment.

B. Exposed-Fastener Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with narrow reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements:

a. Basis of Design: CENTRIA Architectural Systems. Econolap ¾”, or comparable product approved by Architect prior to bid.
b. Alcoa Inc.
c. AEP Span; a BlueScope Steel company.
d. Architectural Building Components.
e. Architectural Metal Systems; a Nucor company.
f. ATAS International, Inc.
g. Berridge Manufacturing Company.
h. MBCI; a division of NCI Building Systems, L.P.

i. Metal-Fab Manufacturing, LLC.

2. Aluminum Face Sheet: Smooth surface coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

   a. Face Sheet Thickness: 0.040 inch.
   b. Surface: Smooth.

3. Panel Coverage: Refer to Construction Documents.
4. Panel Height: Refer to construction documents.
5. Color:
   a. Dove Gray – see plans for location.
   b. Match Architect's custom color – see plans for location.

2.3 CONCEALED FASTENER, LAP SEAM METAL WALL PANEL

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Single skin, concealed-fastener metal wall panels: flush-joint profile with raised flat pan.
   1. Basis of Design: CENTRIA IW Series IW-10A, or comparable product approved by one of the following:
      a. Morin – A Kingspan Group Company.
   2. Aluminum Face Sheet: Smooth surface coil-coated, ASTM B209, 3003-H14 or 5052-H32 alloy.
      a. Face Sheet: 0.040 inch
      b. Surface: Smooth
   3. Panel Coverage: 12 inches
   4. Panel Thickness: 1.5 inches
   5. Color: Match Architect's custom color – see plans for location.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
   1. Z Channels: 16 ga. Minimum.
   2. Sill Channels: 16 ga. Minimum.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Mitered Corners for flat panels: Structurally-bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.
   1. Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.
   2. Basis of Design: CENTRIA, MicroSeam Corners.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners must be stainless steel with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

F. Wall Louvers, General: Metal louvers, designed to integrate with metal wall panel profile and secondary support system without receptor channels or other flashing, of types and performance indicated. Provide manufacturer's standard louver blade clips matching panel color.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed finish: White or light colored-acrylic.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

   a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

   1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 074293
SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal soffit panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including rupturing, cracking, or puncturing.
    b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

    1. Wind Loads: As indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

    1. Temperature Change (Range): 120 deg F, ambient; material surface.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

C. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Berridge
    b. Centria Architectural Systems.
    c. Pac Clad
    d. Metl-Span
    e. Atas

    2. Basis of Design: Berridge FW-12 Panel, vented panels, 1/8” holes staggered.

    3. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

        a. Thickness: 0.040 inch.
        b. Surface: Embossed finish.
        c. Exterior Finish: Three-Coat Fluoropolymer.

d. Color: Match Centria Regal White, coil coat number #431A844. Refer to drawings for locations.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

    a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

SECTION 075323
ELASTOMERIC FULLY ADHERED MEMBRANE ROOFING

PART 1- GENERAL

1.01 SUMMARY

A. Furnish and install elastomeric sheet roofing system, including:
   1. Roofing manufacturer's requirements for the specified warranty.
   2. Preparation of roofing substrates.
   3. Wood nailers for roofing attachment.
   4. Insulation.
   5. Cover boards.
   6. Elastomeric membrane roofing.
   7. Metal roof edging and copings.
   8. Flashings.
   9. Walkway pads.
   10. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.

C. Comply with the published recommendations and instructions of the roofing membrane manufacturer.

Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED SECTIONS

A. Section 061053 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.

B. Section 076200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

Section 077100 – Roof Specialties: Manufactured copings, fascias, gravel stops, and other flashing-related items.

C. Section 077200 - Roof Accessories: Roof hatches, vents, and manufactured curbs.

D. Section 22 10 00 - Plumbing Piping and Roof Drains.

1.03 REFERENCES

A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.

   A. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2006.

   B. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2013.

   C. ASTM D 4637 - Standard Specification for EPDM Sheet used in Single-Ply Roof Membrane; 2004.

   D. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing; 2004.

   E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

   F. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

   G. FM 1-28 - Design Wind Loads; Factory Mutual System; 2007.

   H. FM 1-29 - Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2006.

   I. FM 4470 - Approval Standard - Class I Roof Covers; current version.

   J. PS 1 - Construction and Industrial Plywood; 2009.

   K. PS 20 - American Softwood Lumber Standard; 2010.

   L. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2007. (ANSI/SPRI ES-1).

1.04 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in the section.

B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC S770.

1.05 SUBMITTALS

A. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
   2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.
   3. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.

B. Shop Drawings: Provide:
   1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

C. Pre-Installation Notice: Copy to show that manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.

D. Executed Warranty.

E. Specimen Warranty: Submit prior to starting work.

F. Samples: Submit samples of each product to be used.

G. Manufacturers Tapered Insulation Layout. Provide the tapered insulation shop drawings on the manufacturers authorized tapered design.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Roofing installer shall have the following:
   1. Current manufacturer certified status.
   2. Fully staffed office within 100 miles of the job site.
   3. At least 10 years' experience in installing specified system.
   4. Capability to provide payment and performance bond to building owner.
   5. Capability to provide a payment performance bond.

B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work. Include the roofing contractor foreman and superintendant, project manager, Roof Manufacturer's inspector, owner, architect, CM.
   2. Notify Architect and the owner's representative well in advance of meeting.
   3. All submittals must be approved at time of Pre-installation conference, including an approved PIN from the manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.08 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Warranty: Manufacturer 20-year Warranty covering membrane, roof insulation, and membrane accessories, sheet metal trim as described in the Full System Warranty.

1. Limit of Liability: No dollar limitation.
2. Scope of Coverage: Repair leaks in the roofing system caused by:
   a. Ordinary wear and tear of the elements.
   b. Manufacturing defect in Firestone brand materials.
   c. Defective workmanship used to install these materials.
   d. Damage due to winds up to 72 mph.
   e. Roof Edge Metal including Fascia and Coping.
3. Not Covered:
   a. Damage due to winds in excess of 72 mph.
   b. Damage due to hurricanes or tornadoes.
   c. Hail.
   d. Intentional damage.
   e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer - Roofing System: Firestone Building Products Co., Nashville, TN. www.firestonebpco.com.
   1. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
      a. Specializing in manufacturing the roofing system to be provided.
      b. Minimum ten years of experience manufacturing the roofing system to be provided.
      c. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
      d. ISO 9002 certified.
      e. Able to provide polyisocyanurate insulation that is produced in own facilities.

B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
D. Substitution Procedures: See Instructions to Bidders.
   1. Submit evidence that the proposed substitution complies with the specified requirements.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:
   1. Membrane: Ethylene propylene diene monomer (EPDM).
   2. Thickness: As specified elsewhere.
   3. Membrane Attachment: Fully adhered.
   4. Slope: Deck is sloped but not enough; provide additional slope of 1/4 inch per foot (1:48) by means of tapered insulation.
   5. Comply with applicable local building code requirements.
   6. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.

B. Insulation:
   1. Total System R Value: 33.91, minimum.
   2. Maximum Board Thickness: 3 inches; use as many layers as necessary; stagger joints in adjacent layers.
   3. Base Layer: 3” Polyisocyanurate foam board, non-composite.

a. Attachment: Mechanical fastening.

4. Top Layer: 3” Polyisocyanurate foam board, non-composite.
   a. Attachment: Low-rise polyurethane adhesive.

D. Crickets and Saddles: Tapered insulation of same type as specified for top layer; slope as indicated.
   3. Attachment: Low-rise polyurethane adhesive.

E. Cover Board: Fiberglass Mat, Water Resistant Gypsum Roof Board
   1. Attachment: Low-rise polyurethane adhesive.

2.03 EPDM MEMBRANE MATERIALS

A. Roofing and Flashing Membrane: Black cured synthetic single-ply membrane composed of ethylene propylene diene terpolymer (EPDM) with the following properties:
   1. Reinforcement: None; membrane complying with ASTM D 4637 Type I.
   2. Thickness: 0.060 inch.
   3. Nominal Thickness Tolerance: Plus/minus 10 percent.
   4. Sheet Width: Provide the widest available sheets to minimize field seaming.
   5. Acceptable Product:
      a. Base Bid: RubberGard EPDM Membrane by Firestone.
      b. Mandatory Alternate Bid: FullForce EPDM by Firestone.

B. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Low Rise Polyurethane Adhesive: Two-component, low-rise polyurethane adhesive designed to attach fleece backed roofing membranes to a variety of acceptable substrates.

D. Use accessories and flashings of like color to the primarily specified field EPDM membrane.

E. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D 4811 Type II, and with the following properties:
   1. Thickness: 0.055 inch.

F. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil EPDM tape adhesive.

G. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; Firestone EPDM Pipe Flashing.

H. Self-Adhesive Lap Splice Tape: 35 mil EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer.

I. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces.

J. Bonding Adhesive: Neoprene-based, formulated for compatibility with EPDM membrane and wide variety of substrate materials, including masonry, wood, and insulation facings.

K. Adhesive Primer: Synthetic rubber based primer formulated for compatibility with EPDM membrane and tape adhesive, with VOC content less than 2.1 lb/gal.

L. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams.

M. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing.

N. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed;

O. Metal Plates and Strips Used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.

P. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick.

Q. Roof Walkway Pads: EPDM, 0.30 inch thick by 30 by 30 inches with EPDM tape adhesive strips laminated to the bottom, with no slip surface.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type I Class 1, Grade 2, with the following additional characteristics:
   1. Thickness: As indicated elsewhere.
   2. Size: 48 inches by 96 inches, nominal.
      a. Exception: Insulation to be attached using adhesive may be no larger than 48 inches by 48 inches , nominal.
   3. R-Value (LTTR): 3.0 inch Thickness: 17.4 R, minimum.
   4. Compressive Strength: 20 psi when tested in accordance with ASTM C 1289.
   5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
   6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.

B. Glass Mat, Water Resistant Gypsum Roof Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
   1. Size: 48 inches by 96 inches, nominal.
   2. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   3. Thickness: 0.50 inch.
   4. Surface Water Absorption (ASTM C 473): Nominal 1.0 g.
   5. Water Absorption (ASTM C 473): Less than 5% of weight.
   6. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
   7. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
   8. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
   9. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
   10. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.
   11. Acceptable Product: DensDeck Prime by Georgia Pacific

C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

D. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesives furnished by roof membrane manufacturer.

2.05 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

1. Wind Performance:
    a. Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
    b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
2. Description: Two-piece; OM Gravel stop fascia with modified OM extender as shown on drawings, and 6" wide splice plates.
3. Fascia Face Height: As shown on drawings.
4. Edge Member Height Above Nailer: Maximum 3/4 inch.
5. Length: Maximum 120 inches.
6. Fascia Material and Finish: 24 gage steel with Kynar 500 finish in manufacturer's custom color "White" to match existing.
7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded.
8. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
9. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; maximum 12-inch-long legs on corner pieces.
10. Scuppers: Welded watertight.
11. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated.
1. Wind Performance:
    a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
    b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-180 rating.
2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
3. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish to match roof edge fascia; matching concealed joint splice plates; factory-installed protective plastic film.
4. Dimensions:
    a. Wall Width: As indicated on the drawings.
    b. Piece Length: Minimum 144 inches.
    c. Curved Application: Factory fabricated in true radius.
5. Anchor/Support Cleats: 20 gage, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.
6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.
7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

2.06 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
   1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
   2. Thickness: Same as thickness of roof insulation.

PART 3 INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
C. Examine roof substrate to verify that it is properly sloped to drains.
D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
D. Seal, grout, or tape deck joints, where needed, to prevent material seepage into building.

3.04 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.

E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in specified in PART 2 and membrane manufacturer, whichever is more stringent.

F. Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.05 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

1. Edge Securement: Secure membrane at all locations where membrane terminates or goes

through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
2. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches square.

F. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
1. Follow roofing manufacturer's instructions.
2. Remove protective plastic surface film immediately before installation.
3. Install water block sealant under the membrane anchorage leg.
4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
1. Use the longest practical flashing pieces.
2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
4. Provide termination directly to the vertical substrate as shown on roof drawings.

E. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing

seals directly to the penetration.

1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1 inch clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.07 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
   1. Use specified walkway pads unless otherwise indicated.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
   1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
   2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.08 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.09 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION 075323

SECTION 075416
KETONE ETHYLENE ESTER (KEE) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic KEE roofing system on metal deck, including:

2. Vapor retarder.

3. Roof insulation.

4. Roof insulation cover board.

5. Base-ply / ply sheet.

6. Walkway material.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, Owner's Consultant, and employees, and qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section, UL listed and FM Global approved for roofing systems comparable to that specified for this Project, with minimum five years' experience in manufacture of thermoplastic roof membrane products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

a. Product data, including certified independent test data indicating compliance with requirements.

b. Samples of each component.

c. Sample submittal from similar project.

d. Project references: Minimum of five installations of specified products not less than five years old, with Owner and Owner's Consultant contact information.

e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.5 PROJECT / FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove temporary plugs from roof drains at end of each day.

4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.6 WARRANTY

A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.

1. Form of Warranty: Manufacturer's standard warranty form.

2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.

3. Warranty Period: 30 years from date of completion.

B. Manufacturer Inspection and Preventive Maintenance Service: To report maintenance responsibilities necessary for preservation of Owner's warranty rights and to perform periodic routine maintenance required, as described in Manufacturer's standard form. The cost of manufacturer's inspections and preventive maintenance is included in the Contract Sum.

1. Scope of Service: Manufacturer's standard form.

2. Inspections to occur in following years: 2, 5, 10, 15, 20 and 25 following completion.

C. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.

2. Scope of Warranty: Work of this Section.

3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The roof system specified in this Section is based upon products of Tremco CPG Inc, Beachwood, OH, (800) 562-2728, www.tremcoroofing.com that are named in other Part 2 articles. Provide specified products.

1. Manufacturers of comparable products: Approved by Architect prior to bid.

B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures calculated in accordance with ASCE-7 and applicable code.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to ANSI/SPRI ES-1.

1. Design Pressure: As indicated on Drawings.

D. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:

1. FM Global 1-49: Loss Prevention Data Sheet for Perimeter Flashings.

2. FM Global 1-29: Loss Prevention Data Sheet for Above Deck Roof Components.

3. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.

4. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.

5. Comply with requirements of Division 07 Section "Sheet Metal Flashing and Trim" and Roof Specialties".

E. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

G. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

H. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 MATERIALS, GENERAL

A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

B. FM Global Standards: Roofing, base flashings, and component materials shall be identical to materials that comply with requirements in FM Global 4470 as part of a roofing system listed or approved by FM Global. Identify applicable materials with FM Global markings.

2.4 BASE-PLY / PLY SHEET

A. Base-Ply Sheet:

1. SBS-modified asphalt coated composite polyester / fiberglass/fiberglass mat reinforced high tensile strength base sheet, ASTM D4601 Type II.

a. Basis of design product: Tremco, BURmastic Composite Ply HT.

b. Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 165 lbf/in (725 N); Cross machine direction, 150 lbf/in (660 N).

c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 260 lbf (1150 N); Cross machine direction, 230 lbf (1120 N).

d. Thickness, minimum, ASTM D5147: 0.060 inch (1.5 mm).

2.5 THERMOPLASTIC MEMBRANE MATERIALS

A. KEE Roof Membrane:

1. Thermoplastic Ketone Ethylene Ester (KEE) coated polyester fabric-reinforced fleece-backed sheet, ASTM D6754 .

a. Basis of design product: Tremco, TremPly KEE FB Single Ply Roof Membrane.

b. Breaking Strength, minimum, ASTM D751: Machine direction, 500 lbf (87 kN/m); Cross machine direction 400 lbf (70 kN/m).

c. Tear Strength, minimum, ASTM D751: Machine direction, 125 lbf (22 kN/m); Cross machine direction (145 lbf (25 kN/m).

d. Elongation at Break, ASTM D751: 20 percent.

e. Dynamic Impact/Puncture Resistance, ASTM D5635: Pass.

f. Minimum Membrane Thickness, nominal, less backing, ASTM D751: 60 mils (1.5 mm).

g. Thickness over fiber, optical method: 0.016 inches.

h. Accelerated Weathering, ASTM G155 and ASTM G154: Not greater than 5,000 hr., no cracking or crazing.

i. Abrasion Resistance, ASTM D3389: Not greater than 2,000 cycles, H-18 wheel, 1,000 g load.

j. Color: Grey.

B. Sheet Flashing: Manufacturer's standard, smooth-backed, sheet flashing of same material, type, reinforcement, thickness and color as KEE roof membrane.

2.6 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.

b. Single-Ply Roof Membrane Sealants: 450 g/L.

c. Nonmembrane Roof Sealants: 300 g/L.

d. Sealant Primers for Nonporous Substrates: 250 g/L.

e. Sealant Primers for Porous Substrates: 775 g/L.

B. Base Sheet Adhesive:

1. Cold-applied bio-based low odor urethane roofing adhesive, two-part, USDA BioPreferred, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POWERply Endure BIO Adhesive TF.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3690: 0 g/L.

c. Low Temperature Flexibility, ASTM D2240: Pass at -30 deg F (-34 deg C).

d. Solids, by Volume, ASTM D2697: 100 percent.

e. Biobase Content, Minimum, ASTM D6866: 70 percent.

C. Membrane Bonding Adhesive:

1. Bonding adhesive, solvent-borne. for bonding KEE fleece-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE FB Bonding Adhesive.

b. VOC, maximum, ASTM D3960: 234 gm/L.

2. Bonding adhesive, waterborne low-VOC, for bonding KEE fleece-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE FB WBII Bonding Adhesive.

b. VOC, maximum, ASTM D3960: 153 g/L.

D. Flashing Membrane Adhesive:

1. Bonding adhesive, solvent based fast drying, VOC-compliant, for bonding KEE smooth-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE LV Bonding Adhesive.

b. VOC, maximum, ASTM D 3960: 200 g/L.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 mm by 3 mm) thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to membrane roofing system manufacturer.

H. Fasteners, Induction Welding System: Factory-coated FM Global approved drill point steel fasteners for insulation and membrane attachment to wood, steel and structural concrete roof decks, separation pads, and polyester-backed, adhesive-coated metal stress plates approved for bonding to roofing membrane using welding method described in Part 3, complying with corrosion-resistance provisions in FM Global 4470, and acceptable to membrane roofing system manufacturer.

I. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Basis of design product: Tremco, TremSEAL Pro.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

c. Hardness, Shore A, ASTM C661: 40.

d. Adhesion to Concrete, ASTM C794: 35 pli.

e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).

f. Color: Closest match to substrate.

J. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.7 VAPOR RETARDER

A. Vapor Retarder:

1. Self-Adhering Sheet: Trilaminate woven polyethylene film laminated to layer of reinforced SBS rubberized asphalt adhesive; with slip-resisting surface and release-paper/film backing. Provide primer when recommended by vapor-retarder manufacturer.

a. Basis of design product: Tremco, AVC Max.

b. Tensile Strength, minimum, ASTM D5147: 70 lbf/in (12.25 kN/m) MD; 80 lbf/in (14 kN/m) XMD.

c. Tear Resistance, minimum, ASTM D1970: 125 lbf (556 N) MD; 110 lbf (489 N) XMD.

d. Adhesion to Plywood at 73.4 deg F (23 deg C), ASTM D903/D1970: 25 lb/ft (11.5 kgf/30.5 cm) .

e. Elongation at Break, ASTM D1970: 20 percent MD; 13 percent XMD.

f. Permeance, maximum, ASTM E96/D1970: 0.02 perm (1.1 ng/Pa x s x sq. m).

g. Thickness, minimum: 46 mils (1.2 mm).

h. Resistance to Water leakage (Sealability around nail), ASTM D7349/D1970: Pass.

i. Low Temperature Flexibility, ASTM D1970: Pass.

B. Vapor Retarder Primer:

1. Primer for Self-Adhering Sheet Air and Vapor Control Membrane: quick drying SIS primer.

a. Basis of design product: Tremco, AVC Membrane Primer.

b. Solids: Not less than 50 percent.

2.8 ROOF INSULATION MATERIALS

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from insulation manufacturer's standard sizes, suitable for application, and of thicknesses indicated.

1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Roof Insulation: Provide roof insulation product in thicknesses indicated in Part 3 as follows:

1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.

a. Basis of design product: Tremco, Trisotech Insulation.

b. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).

c. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

d. Total System R-Value: 34.8 min.

2.9 ROOF INSULATION ACCESSORIES

A. Cover Board:

1. Gypsum panel, glass-mat-faced, ASTM C1177/C1177M.

a. Basis of design product: Tremco/GP Gypsum DensDeck.

b. Thickness: 1/2 inch (12 mm).

2. Gypsum panel, cellulosic fiber reinforced, water-resistant, ASTM C1278/C1278M.

a. Basis of design product: Tremco/USG Securock.

b. Thickness: 1/2 inch (13 mm).

B. Roof Insulation Adhesive:

1. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.

a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.

b. Flame Spread Index, ASTM E84: 10.

c. Smoke Developed Index, ASTM E84: 30.

d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

e. Tensile Strength, minimum, ASTM D412: 250 psi (1720 kPa).

f. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.50 kN/m).

g. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Wood Cant Strips: Comply with requirements in Division 06 rough carpentry Section.

E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

F. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

G. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

2.10 WALKWAY MATERIALS

A. Walkway / Protection Mat Material:

1. Protection walkway roll, reinforced KEE membrane roll with diamond-tread, slip-resistant surface, fabricated for heat welding to compatible KEE membrane surface.

a. Basis of design product: Tremco, TremPly KEE Protection Walkway Roll.

b. Roll Size: 30 inches by 100 ft (760 mm by 25.4 m).

c. Thickness: 0.060 inch (1.5 mm).

d. Breaking strength: 450 lbs (77 kN/m).

e. Color: TBD.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Steel Roof Deck:

a. Verify that deck is securely fastened and properly supported with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s written instructions and approved details.

B. Install wood cants, blocking, curbs, and nailers in accordance with requirements of Division 06 Section "Miscellaneous Rough Carpentry."

C. Installation of FM-Compliant Roof Assemblies: Install roofing membrane, base flashings, and component materials in compliance with requirements in FMG 4470 as part of a membrane roofing system as listed in FMG’s “Approval Guide” for fire/windstorm classification indicated. Comply with recommendations in FMG Loss Prevention Data Sheet 1-49.

D. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements of FM Global references if applicable.

3.4 VAPOR-RETARDER INSTALLATION

A. Vapor Retarder Installation, General: Completely seal vapor retarder/air barrier at terminations, obstructions, and penetrations to prevent air movement into roofing system. Seal vapor retarder/air barrier to air barrier in adjacent construction at perimeter of roofing system.

B. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.

3.5 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.

1. Where crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope, not less than 1/4 inch in 12 inches (1:48).

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

F. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.

2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

G. Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together.

1. Secure cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.

2. Adhere cover boards by setting in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover board in place.

3.6 BASE-PLY / PLY SHEET INSTALLATION

A. Install lapped base-ply sheet course, extending sheet over and terminating beyond cants. Attach base ply sheet as follows:

1. Mechanically fasten to substrate.

2. Adhere to substrate in a full application of cold-applied adhesive.

3.7 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Solvent-Based Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow adhesive to become tacky before installing membrane roofing; do not allow adhesive to fully dry. Roll membrane into adhesive. Do not apply adhesive to splice area of membrane.

E. Water-Based Bonding Adhesive: Apply to substrate at rate required by manufacturer. Install membrane immediately into adhesive, avoiding any air entrapment; do not allow adhesive to dry. Roll membrane into wet adhesive. Do not apply adhesive to splice area of membrane.

F. Two-component Elastomeric Urethane, Bonding Adhesive: Mix and apply to substrate at rate required by manufacturer. Install membrane into adhesive, avoiding any air entrapment; do not allow adhesive to dry. Roll membrane into wet adhesive. Do not apply adhesive to splice area of membrane

G. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

H. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

I. Welded Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.

   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

J. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

K. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Seal top termination of base flashing with a metal termination bar and a continuous bead of joint sealant.

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. FRP Roof Walkways: Install FRP walkways in accordance with requirements of Division 07 Section "Roof Walkways."

3.10 FIELD QUALITY CONTROL

A. Roofing Inspector: Contractor shall engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.

1. Engage a qualified roofing inspector for a minimum of 5 full-time days on site, per 40-hour crew week, to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with applicable criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing Systems."

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition

free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075416

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured through-wall flashing with counterflashing.
2. Manufactured reglets with counterflashing.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.
6. Formed equipment support flashing.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is FM Approvals approved.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. FM Approvals Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

   a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: White
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall, Ribbed, Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch intervals along length of flashing to provide integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.

1. Stainless Steel: 0.016 inch thick.

B. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Material: Stainless steel, 0.019 inch thick.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
4. Accessories:

   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

5. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

J. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch-wide, exposed cover plate.
2. Fabricate from the Following Materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch-wide, exposed cover plate.
3. Fabricate from the Following Materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

C. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.

1. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch thick.

D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

E. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

F. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Valley Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Drip Edges: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

F. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Apply slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."

C. Reglets: Installation of reglets is specified in Section 033000 "Cast-in-Place Concrete." & Section 042000 "Unit Masonry."

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Reglets and counterflashings.
3. Copings.
4. Roof-edge specialties.
5. Roof-edge drainage systems.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and trim.
3. Section 077200 "Roof Accessories" for curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness.

a. Surface: Smooth, flat finish.
b. Finish: Three-coat fluoropolymer.
c. Color: Custom “White” to match existing.

2. Corners: Factory mitered and continuously welded or mechanically clinched and sealed watertight.
3. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness.

   a. Surface: Smooth, flat finish.
   b. Finish: Three-coat fluoropolymer.
   c. Color: White.

2. Corners: Factory mitered and continuously welded or mechanically clinched and sealed watertight.
3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
4. Receiver: Manufacturer's standard material and thickness.
5. Corners: Factory mitered and continuously welded or mechanically clinched and sealed watertight.

2.3 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Stainless Steel: 0.025 inch thick.
2. Corners: Factory mitered and continuously welded.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
1. Stainless Steel: 0.025 inch thick.

C. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

D. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).

2.4 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 ft., concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Formed Aluminum Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.
   a. Surface: Smooth, flat
   b. Finish: Two-coat fluoropolymer
   c. Color: As selected by Architect from manufacturer's full range
2. Corners: Factory mitered and continuously welded.

2.5 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 ft. and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. Formed Aluminum Fascia Covers: Aluminum sheet, thickness as required to meet performance requirements.
   a. Surface: Smooth, flat finish.
   b. Color: As selected by Architect from manufacturer's full range.
2. Corners: Factory mitered and continuously welded.

B. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 ft. with a horizontal flange and vertical leg fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.

1. Formed Aluminum Gravel Stops: Aluminum sheet, thickness as required to meet performance requirements.
   a. Surface: Smooth, flat finish.
   b. Color: As selected by Architect from manufacturer's full range.

2.6 ROOF-EDGE DRAINAGE SYSTEM

A. Gutters: Manufactured in uniform section lengths not exceeding **12 ft.** with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Formed Aluminum Sheet: 0.040 inch thick.
2. Gutter Profile: As indicated.
3. Applied Fascia Cover (Concealed Gutter): Exposed, formed aluminum, 0.040 inch thick, with factory mitered corners, ends, and concealed splice joints.
4. Gutter Supports: Gutter brackets.
5. Gutter Accessories: Continuous foam leaf guard.

B. Downspouts: Plain rectangular complete with **smooth-curve** elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Formed Aluminum Sheet: 0.040 inch thick.

2.7 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

2.8 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
   3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
   4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

B. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:

   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.

      a. Three-Coat Fluoropolymer: AAMA 62D. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear top coat. Prepare,

pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.4 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Roof hatch.
3. Equipment supports.
4. Pipe and duct supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
3. Section 077100 "Roof Specialties" for manufactured fascia, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: As indicated on drawing or equipment product data.

D. Material: Aluminum-zinc alloy-coated steel sheet, 0.064 inch thick.

1. Finish: Factory prime coating.
2. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated use of leveler frame.
5. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
7. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
8. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, and integrally formed structure-mounting flange at bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: As indicated on drawing or equipment product data.

D. Material: Aluminum-zinc alloy-coated steel sheet, 0.064 inch thick.

1. Finish: Factory prime coating.
2. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.

3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers min. 3-1/2 inches wide on top flange of equipment supports, continuous around support perimeter.
5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.

2.4 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Manufacturers:

   a. Bilco Company (The).

2. Type and Size: Thermally Broken Single leaf lid, 36 by 36 inches.
3. Material: Cover and frame are 11 gauge aluminum.
4. Cover: Brake-formed, hollow-metal design with 3″ concealed polyisocyanurate insulation (R Value of 20+), 5″ beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load.
5. Curb: 12″ in height with integral cap flashing, 3″ polyisocyanurate insulation (R Value of 20+), fully welded at corners, and 5-1/2″ mounting flange with 7/16″ holes provided for securing frame to the roof deck.
6. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
7. Hinges: Heavy-duty pintle hinges with 3/8″ Type 316 stainless steel hinge pins.
8. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
9. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
10. Finish: Mill finish aluminum
11. Hardware: Engineered composite compression spring tubes and steel compression springs packed in grease. Type 316 stainless steel hinges. All other hardware is zinc plated/chromate sealed.
12. Ladder Safety Post: Manufacturer’s standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.

B. Fasteners: Manufacturer’s standard.

2.5 PIPE AND DUCT SUPPORTS

A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch-diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with polycarbonate roller carrying assembly accommodating up to 7-inch-diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

C. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless-steel threaded rod designed for adjusting support height, accommodating up to 18 inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

D. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

2.6 METAL MATERIALS

A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

2.7 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

F. Seal joints with butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413
PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 22 and 23 Sections specifying duct and piping penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings indicated at both ambient temperatures and 400 deg F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

D. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

E. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

        1) UL in its "Fire Resistance Directory."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined bybuilding inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application.

1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078446
FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Grace Construction Products.
   b. Hilti, Inc.
   c. Johns Manville.
   d. 3M Fire Protection Products.
   e. Tremco, Inc.; Tremco Fire Protection Systems Group.
   f. USG Corporation.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

   1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wgat both ambient and elevated temperatures.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. Grace Construction Products.
      b. Hilti, Inc.
      c. Johns Manville.
      d. 3M Fire Protection Products.
      e. Tremco, Inc.; Tremco Fire Protection Systems Group.
      f. USG Corporation.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.5 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Wall-to-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: 1 hour.
2. Nominal Joint Width: As indicated.
3. Movement Capabilities: Class I.
4. L-Rating: As required by 2009 Michigan Building Code.

B. Head-of-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: 1 hour.
2. Nominal Joint Width: 2” or less at steel deck.
3. Movement Capabilities: Class I.
4. L-Rating: As required by 2009 Michigan Building Code.

C. Perimeter Fire-Resistive Joint Systems:

1. Integrity Rating: 1 hour.
2. Insulation Rating: 1 hour.
3. Linear Opening Width: As indicated.
4. Movement Capabilities: Class I.
5. L-Rating: As required by 2009 Michigan Building Code.

END OF SECTION 078446

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Polysulfide joint sealants. Butyl joint sealants.
6. Acoustical joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

C. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.4 URETHANE JOINT SEALANTS

A. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.8 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide the following:

   a. Pecora Corporation; AC-20 FTR or AIS-919.
   b. USG Corporation; SHEETROCK Acoustical Sealant.

2.9 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Control and expansion joints in unit masonry.
   c. Joints in dimension stone cladding.
   d. Joints between metal panels.
   e. Joints between different materials listed above.
   f. Perimeter joints between materials listed above and frames of doors windows and louvers.
   g. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, NS, 50, T, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

   a. Control and expansion joints in tile flooring.

2. Joint Sealant: Urethane, S, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry.
    d. Joints on underside of plant-precast structural concrete planks.

2. Joint Sealant: Urethane, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

    a. Aluminum thresholds.
    b. Sill plates.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

    a. Acoustical joints where indicated.

2. Joint Sealant: Acoustical
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.
2. Standard hollow borrowed light frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
4. Division 09 Section “Exterior Painting” and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Material Compliance Certificate: Submit completed material compliance certificate as described in Specification Section 013300 – Architect's Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Pioneer Industries, Inc.
4. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.
   a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
   b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.6, including insulated door, Mercury thermal-break frame and threshold.
   c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches.
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet with metallic-coated sheet at all toilet rooms, locker rooms, janitor closets and other wet locations.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
5. Frames for Wood Doors: 0.053-inch- thick steel sheet.
6. Frames for Borrowed Lights: 0.053-inch- thick steel sheet.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on secure side of interior doors and frames.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Glazed Lites: Factory cut openings in doors.
2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for

securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Factory finishing flush wood doors.
2. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 081113 "HM doors and Frames" for hollow metal frames.
2. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of mortises and holes for hardware.
2. Dimensions and locations of cutouts.
3. Doors to be factory finished and finish requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.5 INFORMATIONAL SUBMITTALS

~~A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.~~

1.6 QUALITY ASSURANCE

~~A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.~~

~~B. Vendor Qualifications: A vendor that is certified for chain-of-custody by an FSC-accredited certification body.~~

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham Wood Doors; an Assa Abloy Group company.
4. Marshfield Door Systems, Inc.
5. Mohawk Doors; a Masonite company.
6. Oshkosh Door Company.
7. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ~~AWI's~~, AWMAC's, and WI's "Architectural Woodwork Standards."

~~1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.~~
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits, and where indicated.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

F. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:

   a. 5-inch top-rail blocking, in doors indicated to have closers.
   b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
   c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

G. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

   a. Screw Withdrawal, Face: 700 lbf.

H. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

   a. 5-inch (125-mm) top-rail blocking.

b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Oak to match existing.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
10. Core: Particleboard.
11. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
12. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-6 catalyzed polyurethane.
3. Staining: Custom color to match existing.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

   1. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 081816.23
MULTIPANEL SLIDING WOOD-FRAMED ACRYLIC DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel sliding wood-framed acrylic doors.

B. Related Requirements:

1. Section 087100 "Door Hardware" for hardware not specified in this Section.
2. Section 099300 "Staining and Transparent Finishing" for on-site finishing of unfinished multipanel sliding wood-framed acrylic doors.
3. Section 099123 "Interior Painting" for on-site finishing of factory-primed multipanel sliding wood-framed acrylic doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for multipanel sliding wood-framed acrylic doors.

B. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

C. Samples for Initial Selection: For doors and hardware with factory-applied color finish.

D. Product Schedule: For multipanel sliding wood-framed acrylic doors.

1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For multipanel sliding wood-framed acrylic doors to include in maintenance manuals. Include finishes, operable panels, and operating hardware.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to multipanel sliding wood-framed acrylic door manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel sliding wood-framed doors that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure to meet performance requirements.
    b. Structural failures, including excess deflection.
    c. Faulty operation of movable panels and hardware.
    d. Deterioration of wood, metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period:

    a. Multipanel Sliding Wood-Framed Acrylic Doors: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of Design: Raydoor Sliding Wall with Soft Close, 4 Panels (SW4-SC)
2. Architect’s pre-approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

2.3 MULTIPANEL SLIDING WOOD-FRAMED ACRYLIC DOORS

A. Multipanel Sliding Wood-Framed Acrylic Doors: Provide multipanel wood-framed sliding acrylic doors, designed for interior use, complete with glazing and support devices.

1. Stack Storage Configuration: Panels open from center to both sides, and are stored within opening

2. Door Panel Design: Narrow-profile design, with 10-inch nominal height bottom rail.

B. Wood Finish: Manufacturer's standard factory-applied primer.

2.4 ACRYLIC INSERT

A. Acrylic insert: Manufacturer's standard system that produces weathertight seal.

1. Frosted acrylic insert.

2.5 HARDWARE

A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel sliding wood-framed acrylic doors. Size hardware to accommodate panel weights and dimensions.

B. Single-Track Top-Supported Panel System: Provide panel support system designed for size, weight and performance requirements of multipanel sliding wood-framed acrylic doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.

1. Overhead Carriers: Provide overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than 0.10 inch between supports when fully loaded. Provide carriers with sealed ball bearings.
2. Stacking Track System: Provide intersections, and accessories required for operation, storage, track configuration, and layout indicated for multipanel sliding wood-framed acrylic doors.
3. Lock: Provide manufacturer's standard multipoint locking device on each movable panel, lockable from the outside.

   a. Trim Design: No Lattice
   b. Trim Finish: As selected from manufacturer's full range of finishes.
   c. Cylinders: Manufacturer's standard.

2.6 FABRICATION

A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

B. Factory-Glazed Fabrication: Glaze sliding wood-framed acrylic doors in the factory.

2.7 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 WOOD FINISHES

A. Factory-Applied Primer: Provide manufacturer's standard factory-applied prime coat complying with WDMA LS.1-A Performance Grade on exposed exterior and interior wood surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight hinged door installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel sliding wood-framed acrylic doors, hardware, accessories, and other components.

B. Install multipanel sliding wood-framed acrylic doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

3.3 ADJUSTING

A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

B. Adjust hardware and operable panels to function smoothly, and lubricate as recommended by manufacturer.

3.4 CLEANING

A. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

B. Remove and replace acrylic that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.5 PROTECTION

A. Protect multipanel sliding wood-framed acrylic door surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.

B. Refinish or replace sliding wood-framed acrylic doors with damaged finishes.

END OF SECTION 081816.23

SECTION 083113
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
2. Division 07 Section "Roof Accessories" for roof hatches.
3. Division 09 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.
4. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

   a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Manufacturer's standard.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. J. L. Industries, Inc.
4. Larsen's Manufacturing Company.
5. Milcor Inc.

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.

1. Locations: New masonry walls.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Latch: Cam latch operated by hex head wrench with interior release.

C. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Gypsum wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- thick sheet metal with drywall or plaster bead flange as required for finish type.
4. Hinges: Continuous piano.
5. Latch: Cam latch operated by hex head wrench with interior release.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from sheet material as noted for non-fire rated access doors and frames.

1. Locations: As noted for non-fire rated doors and frames.
2. Fire-Resistance Rating: Not less than that indicated on code composite plan, ceiling notes, and partition types.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.

8. Latch: Self-latching device operated by hex head wrench with interior release.

E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from sheet material as noted for non-fire rated access doors and frames.

1. Locations: As noted for non-fire rated doors and frames.
2. Fire-Resistance Rating: Not less than that indicated on code composite plan, ceiling notes, and partition types.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by hex head wrench with interior release.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: As indicated.
2. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
4. Provide mounting holes in frames for attachment of units to metal or wood framing.
5. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Coiling Counter Door Assembly.
2. Roll-up Door Assembly.
3. Fire-Rated Roll-up Door Assembly.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 PERFORMANCE REQUIREMENTS

A. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UBC Standard 7-2; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 COILING COUNTER DOOR ASSEMBLY

A. Coiling Doors: Manual rolling counter doors with integral frame and countertop, slip-in type.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Basis of Design: Cornell Iron Works, Inc. Model ESC20.
b. Cookson Company.
c. Overhead Door Corporation.
d. Raynor.
e. Wayne-Dalton Corp.

B. Fabrication:

1. Factory weld head, and jambs and countertop into single unit, fully assembled, ready for installation.

C. Materials

1. Curtain:

a. Slat Configuration:

1) Stainless Steel: **:** No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, 22 gauge AISI type 304 #4 finish stainless steel with stainless steel angle bottom bar with lift handles and vinyl astragal.

b. Finish:

1) Stainless Steel: Type 304 #4 Finish

2. Endlocks:

a. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats.

3. Head and Jamb Frame: Integral welded with guide groove incorporated into jamb design. Build to fit 7-3/4" wall thickness.

a. Fabrication: Stainless steel: 16 gauge AISI 300 series formed shapes.
b. Finish: Stainless steel: type 304 #4 finish.

4. Countertop: Stainless Steel**:** Integral 14 gauge AISI 300 series stainless steel formed shape; type 304 #4 finish.

5. Counterbalance Shaft Assembly: Barrel**:** Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

6. Brackets: Fabricate from reinforced AISI 300 series stainless steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures for hood.

a. Finish: Stainless steel: type 304 #4 finish.

7. Hood and Fascia: 16 gauge stainless steel with reinforced top and bottom edges.

a. Finish: Stainless steel: type 304 #4 finish.

D. Operation

1. Manual push-up: Provide lift handles on bottom bar and pole with hook.
2. Locking Device: Slide bolt on inside.

2.2 ROLL-UP DOOR ASSEMBLY

A. Door Curtain Materials And Construction

1. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated.
2. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
3. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
4. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
5. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

B. Hood

1. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

    a. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

C. Locking Devices

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

    a. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
    b. Keys: Provide three for each cylinder.

3. Chain Lock Keeper: Suitable for Padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

D. Counterbalancing Mechanism

1. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
3. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
4. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

E. Electric Door Operators

1. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

    a. Comply with NFPA 70.
    b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
3. Door Operator Location(s): Operator location indicated for each door.

    a. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.

    a. Electrical Characteristics:
        1) Phase: Single phase.
        2) Volts: 115 V.
        3) Hertz: 60.

    b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
    c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not

less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

5. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

6. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

   a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

      1) Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

   a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

   b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

8. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.3 FIRE-RATED ROLL-UP DOOR ASSEMBLY

A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cookson Company.

b. Cornell Iron Works, Inc.
c. Overhead Door Corporation.
d. Raynor.
e. Wayne-Dalton Corp.

B. Operation Cycles: Not less than 20,000.

C. Fire Rating: 3/4 hr with smoke seal.

D. Door Curtain Material: Galvanized Steel: Slats and hood shall be galvanized steel in accordance with ASTM A 525 and receive rust-inhibitive, roll coating process, including bonderizing, 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester (powder coated) top coat. Color: Gray polyester top coat. (Power coating finish in color as selected by Architect from manufacturer's standard colors).

E. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: As shown on Drawings.

H. Electric Door Operator:

1. Usage Classification: Standard duty, up to 60 cycles per hour.
2. Operator Location: Top of hood.
3. Motor Exposure: Interior.
4. Obstruction Detection Device: Automatic photoelectric sensor.
5. Remote-Control Station: Where shown on Drawings.
6. Other Equipment: Audible and visual signals.

I. Motor Operation:

1. Basis of Design: Cornell Rolling Fire Door (ERD11) AlarmGard Advanced Fire Door Motor Operation: UL, cUL listed NEMA 1 enclosure, horsepower as recommended by manufacturer, 115v single phase service. Provide a totally enclosed non ventilated motor, removable without affecting the setting of limit switches; thermal overload protection, planetary gear reduction, adjustable rotary limit switch mechanism and a transformer with 24v secondary output. All internal electrical components are to be prewired to terminal blocks.

a. Provide a failsafe motor operated door assembly requiring no ancillary or externally mounted release devices, cables, chains, pulleys, reset handles or mechanisms.
b. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations.
c. Provide an internal solenoid brake mechanism to hold the door at any position during normal door operation.

d. Provide logic for 2 fully monitored safety reversing devices such that the failure of any single monitored device will cause the motor operator to automatically revert to constant pressure to close.
e. Electrically activate door system automatic closure by notification from local detectors or power outage exceeding 6 hours with R-BBU battery backup system.
f. Provide an automatic alarm closure selectable time delay of zero or ten seconds.
g. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices.
h. Maintain automatic closure speed at not more than 9” (229 mm) per second.
i. Enable safety edge function during alarm closing while power is present for 1 cycle. Enable door to rest upon obstruction following this sequence.
j. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of the alarm signal without requiring human interaction.
k. Provide selectable ability for the door system to automatically self-cycle to the fully open position following automatic reset without requiring human interaction.
l. Provide an integral, non-resettable cycle counter.
m. Ensure that manual resetting of spring tension, release devices, linkages or mechanical dropouts will not be required.
n. Provide minimum #50 roller chain for drive connection from motor drive assembly to the door drive shaft.
o. Install system only with manufacturer supplied or specified fasteners.
p. Notify electrical contractor to mount control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the door system wiring instructions.
q. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5

J. Curtain Accessories

1. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:

a. Replaceable fusible links with temperature rise and melting point of 165 deg F interconnected and mounted on both sides of door opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.
3. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.

e. FRP panel.
f. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.03 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

2. Entrance Doors:

a. Single Doors: Maximum air leakage of 0.4 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURERS

A. Manufactures aluminum storefront and frames: Subject to compliance with requirements provide storefront framing and frames as follows:

1. Basis of Design – Special-Lite SL-450TB or Architects pre-approved equal.
2. Tubelight
3. Kawneer
4. EFCO.

B. Manufactures aluminum entry doors: Subject to compliance with requirements provide entry doors as follows:

1. Basis of Design – Special-Lite – SL-15 or Architects pre-approved equal.
2. Tube-Lite
3. Kawneer
4. EFCO

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Frame Size: Refer to drawings.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Aluminum Entrance Doors: Manufacturer's standard flush and glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: As indicated on drawings. Changes to indicated door styles shown will not be allowed.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

B. FRP Entrance Doors: Flush FRP door shall be SL-17 as manufactured by Special Lite.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide non-removable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

   1. Color: Match structural sealant.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using manufactures standard system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Clear anodized to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 084523
FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated translucent sandwich panel system as shown and specified. Work includes providing and installing:

1. Translucent wall panel assembly 2-3/4” with 3” frame.

1.2 SUBMITTALS

A. Submit manufacturer’s product data. Include construction details, material descriptions, profiles and finished of components.

B. Shop Drawings: For panel assemblies. Include plans, elevations, sections, details, and attachments to other work. The window shop drawings to include Kalwall panels.

1. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
2. Pre-construction Testing Shop Drawings: Prepared by a qualified pre-construction testing agency, showing details of laboratory mockup.

   a. Resubmit Shop Drawings with changes made to details of laboratory mockup to successfully complete pre-construction testing.

C. Submit manufacturer’s color charts showing the full range of colors available for factory finished aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and size indicated below.

   a. Sandwich panels: 14” x 28” units
   b. Factory finished aluminum: 5” long sections.

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product test reports from a qualified independent testing agency indicating each type and class of panel system that complies with the project performance requirements, based on comprehensive

testing of current products. Previously completed test reports will be acceptable for current manufacturer and if indicative of products used on this project.

1. Test reports required are:

    a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card.
    b. Burn Extent (ASTM D-635)
    c. Color Difference (ASTM D-2244)
    d. Abrasion/Erosion Resistance (ASTM D-4060)
    e. Impact Strength (UL 972)
    f. Bond Tensile Strength (ASTM C-297 after aging by ASTM D-1037)
    g. Bond Shear Strength (ASTM D-1002)
    h. Beam Bending Strength (ASTM E-72)
    i. Insulation 'U' Factor (NFRC-100)
    j. NFRC System Certification
    k. Condensation Resistance Factor (AAMA 1503)
    l. Illumination study prepared by a registered P.E. Analysis will be based on actual product proposed for this project.

F. Submit current documentation indicating regular, independent quality control monitoring under a nationally recognized building cod review and listing program.

G. Qualification Data: Qualified manufacturer must have a minimum of ten (10) years experience making their current product offering.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for panel assemblies. All tests must represent current product being offered for this project.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten (10) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been in successful use for ten (10) years or longer.
2. Panel system must be listed by the International Code Council – Evaluation Service (ICC-ES) which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an approved agency.
3. Quality control inspections and required testing shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with "Acceptance Criteria for Sandwich Panels" as regulated by the ICC-ES.

B. Installer Qualifications: Installation shall be by an experienced installer, that has been in business of installing specified panel systems for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

C. Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Product Options: Information on Drawings and in Specifications established requirements for panel assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.

1.4 DELIVERY STORAGE AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge, several inches above the ground, blocked and under cover in accordance with the manufacturer's storage and handling instructions.

1.5 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work which fails in materials and workmanship within two (2) years of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work. Fibrebloom: Manufacturer's standard 25 year fiberbloom warranty, whereby manufacturer agrees to repair or replace panels exhibiting defects in materials or workmanship.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Kalwall Corporation, tel: (800-258-9777 - fax: (603) 627-7905 - e-mail: info@kalwall.com

B. Manufacturer's not listed may bid as a voluntary alternate only.

2.2 PANEL COMPONENTS / PERFORMANCE REQUIREMENTS

A. Face Sheets

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.

2. Flammability of interior face sheets.
   a. Flamespread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flamespread rating no greater than 20 and smoke developed no greater than 200 when tested in accordance with UL 723.

b. Burn extent by ASTM D-635 shall be no greater than 1".
c. Face sheets shall not deform, deflect or drip when subjected to fire or flame.
d. Face sheets shall not delaminate when exposed to 200°F for 30 minutes per IBC and NBC (300°F for 25 minutes per UBC and SBC).

3. Weatherability of exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3.0 CIE Units DELTA E by ASTM D-2244 after five years outdoor south Florida weathering at 5 degrees facing south, determined by the average of at least three (3) white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching, utilizing ASTM 4060.
   b. Erosion barrier: Exterior face shall have a permanent glass erosion barrier embedded beneath the surface to provide long-term resistance to reinforcing fiber exposure. Exterior fact surface loss shall not exceed .7 mils and 40 mgs when tested in accordance with ASTM D-4060 employing CS17 abrasive wheels at a head load of 500 grams for 1000 cycles. Sacrifical surface films or coatings are not acceptable erosion barriers.

4. Appearance:
   a. Exterior face sheets: Smooth, 0.070" thick and Crystal in color.
   b. Interior face sheets: Smooth, 0.045" thick and White in color.
   c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

5. Strength: Exterior face sheets shall be uniform in strength, impenetrable by hand held pencil and repel an impact equal to 70 (230) ft.lbs. at gymnasium without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972. Interior High Impact Sheets shall comply with 230 lbs of impact resistance.

B. Grid Core

1. Aluminum I-beam grid core shall be of 6063-T6 or 6005T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16". The I-beam grid shall be machined to tolerances of not greater than ± .002".
2. Thermal break: Minimum 1/2" - 3/4". Pour and de-bridge thermal break grid cores are not acceptable.

C. Laminate Adhesive

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives."
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C-297 after two (2) exposures to six (6) cycles each of the aging conditions prescribed by ASTM D-1037.
3. Minimum shear strength of the panel adhesive by ASTM D-1002 after exposure to five (5) separate conditions:
   a. 50% Relative Humidity at 73°F: 504 PSI
   b. 182°F: 100 PSI
   c. Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI
   d. Accelerated Aging by ASTM D-1037 at 182°F: 250 PSI
   e. 500 Hour Oxygen Bomb by ASTM D-572: 1400 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking thermally broken (aluminum) I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 2-3/4”
2. Light transmission: 12%
3. SHCG = .17
4. ‘U’ factor by NFRC certified laboratory: 0.14 for 2-3/4” panel. (System certified “U” value to be 0.48.)
5. Grid pattern: Nominal 12” x 24” shoji.

B. Panels shall deflect no more than 1.9” at 30 psf in 10’-0” span without a supporting frame by ASTEM E-72.

C. Panels shall withstand 1200°F fire for minimum one (1) hour without collapse or exterior flaming.

D. Thermally broken panels:

1. Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.
2. Minimum CRF of 90 at center of grid cell.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure System: Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

1. Thermally broken perimeter system shall have a urethane bridge.

B. Sealing Tape: Manufacturer’s standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish: Exposed aluminum to be manufacturer’s factory applied finish that meets the performance requirements of AAMA 2604.

1. Color: Gray.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, supporting structure and installation conditions. Do not proceed with panel erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.
3. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

3.3 INSTALLATION

A. Install the panel system in accordance with the manufacturer's installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 CLEANING

A. Clean the panel system inside and outside, immediately after installation, according to manufacturer's written recommendations.

END OF SECTION 084523

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware.
2. Electronic access control system components.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

   a. “Metal Doors and Frames”
   b. “Flush Wood Doors”
   c. “Stile and Rail Wood Doors”
   d. “Interior Aluminum Doors and Frames”
   e. "Aluminum-Framed Entrances and Storefronts"

6. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL, LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

   a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
   b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
   1) Details of interface of electrified door hardware and building safety and security systems.
   2) Schematic diagram of systems that interface with electrified door hardware.
   3) Point-to-point wiring.
   4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Final approved hardware schedule edited to reflect conditions as installed.
d. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
e. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. fire door assemblies, in compliance with NFPA 80.
b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Pre-installation Conference

a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
b. Inspect and discuss preparatory work performed by other trades.
c. Inspect and discuss electrical roughing-in for electrified door hardware.
d. Review sequence of operation for each type of electrified door hardware.
e. Review required testing, inspecting, and certifying procedures.
f. Review questions or concerns related to proper installation and adjustment of door hardware.

2. Electrified Hardware Coordination Conference:

a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
1) Locks
a) Schlage L Series: 3 years
2) Exit Devices

a) Von Duprin: 3 years
3) Closers
a) LCN 4000 Series: 30 years
4) Automatic Operators
a) LCN: 2 years

b. Electrical Warranty
1) Locks
a) Schlage: 1 year
2) Exit Devices
a) Von Duprin: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category are only to be considered by official substitution request in accordance in section 01 25 00.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

2. Acceptable Manufacturers and Products:

a. Hager BB1191/1279 series
b. McKinney TB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high

b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Select
   b. Pemko

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.

6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

a. Securitron CEPT-10

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Burns
   b. Rockwood

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.08 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

   a. Sargent 8200 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
    b. Lever Design: 03A.

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

    a. Sargent 19-43-GL-80 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.

9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.10 ELECTRONIC ACCESS CONTROL LOCKSETS AND EXIT DEVICE TRIM

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Schlage AD series

2. Acceptable Manufacturers and Products:

   a. No Substitute

B. Requirements:

1. Provide adaptable electronic access control products that comply with the following requirements:

   a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
   b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
   c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
   d. Compliant with ASTM E330 for door assemblies.
   e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada IC.

2. Functions: Provide functions as scheduled that are field configurable without taking the adaptable electronic product off the door.
3. Emergency Override: Provide mechanical key override; cylinders: Refer to “KEYING” article, herein.
4. Levers:

   a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal lock components from vandalism by excessive force.
   b. Provide non-handed lever trim that operates independently of non-locking levers.
   c. Style: TLR (Tubular).

d. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

5. Features:

   a. Audible feedback that can be enabled or disabled.
   b. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.
   c. Visual tri-colored LED indicators that indicate activation, additional PIN code credential required, operational systems status, system error conditions and low power conditions.
   d. Door Position Switch
   e. Interior Cover Tamper Guard
   f. Mechanical Key Override
   g. Request to Exit
   h. Request to Enter
   i. Lock/Unlock Status

6. Credential Reader:
   1) Credential Reader Configuration: Provide credential reader modules in the configurations as indicated in door hardware sets.
   2) Credential Reader Capabilities: Provide credential readers capable of operating with the following integrated software partners.
      a) 13.56 MHz Smart card credentials:
         i. Secure section (Multi-Technology and Smartcard): Schlage MIFARE Classic, Schlage MIFARE DESFire EV1/EV3, PIV and PIV-I Compatible
         ii. 13.56 MHz Serial number only (Multi-Technology and Smartcard): MIFARE, DESFire, HID iClass, MIFARE DESFire EV1/EV3
         iii. 125 kHz Proximity card credentials: Schlage, XceedID, HID, GE/CASI ProxLite and AWID.
      b) Multi-Technology readers that read both 13.56 MHz Smart Cards and 125 kHz Prox cards.
      c) Dual credential reading capabilities credential card and fob.

7. Operation:

   a. Networked – hardwired
      1) Adaptable electronic access control product system interface:
      2) Adaptable electronic access control products to have real-time bidirectional communication between access control system and lock.
      3) Credential Verification Time: less than 1 second.
      4) When Utilized with Partner Integrated Access Control Network Software with Remote Commanding Capability: Provide adaptable electronic access control product with the ability to be remotely locked down or unlocked within 10 seconds or less, without user interface at the device.
      5) Upon Loss of Power to Device: Provide adaptable electronic access control product with the ability to manage access control offline in one of three methods below that can be configured in the field at lockset by handheld programming device and remotely by Partner integrated software:
         a) Fail locked (secured)

b) Fail unlocked (unsecured)
c) Fail As-Is

6) Upon Loss of Communication Between Device and Network: Provide adaptable electronic access control product with the ability to manage access control offline in one of four methods below that can be configured in the field at device by handheld programming device and remotely by Partner integrated software:
   a) Fail locked (secured)
   b) Fail unlocked (unsecured)
   c) Fail As-Is
   d) Fail to Degraded/cache mode utilizing cache memory with following selectable options:
      i. Grant access up to the last 1,000 unique previously accepted User IDs.
      ii. Grant access up to the last 1,000 unique previously accepted facility/site codes.
      iii. Remove from cache previously stored User IDs or facility/site codes that have not been presented to lock within the last 5 days.
7) Provide adaptable electronic access control product with the ability to be configured at door by handheld programming device and remotely by Partner integrated software the length of time device is unlocked upon access grant.
8) Provide adaptable electronic access control product with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device and remotely by Partner integrated software.

C. Components:

1. Provide Panel Interface for adaptable electronic access control products.

   a. Product: Schlage PIB300-2D Panel Interface Board.

2.11 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Von Duprin 6000 series

2. Acceptable Manufacturers and Products:

   a. Folger Adam 300 series
   b. HES 1006 and 9500 series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.12 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Schlage/Von Duprin PS900 series

2. Acceptable Manufacturers and Products:

   a. Securitron BPS series
   b. Security Door Controls 600 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

   a. 12/24 VDC Output, field selectable.
   b. Class 2 Rated power limited output.
   c. Universal 120-240 VAC input.
   d. Low voltage DC, regulated and filtered.
   e. Polarized connector for distribution boards.
   f. Fused primary input.
   g. AC input and DC output monitoring circuit w/LED indicators.
   h. Cover mounted AC Input indication.
   i. Tested and certified to meet UL294.
   j. NEMA 1 enclosure.
   k. Hinged cover w/lock down screws.
   l. High voltage protective cover.

2.13 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Best

2. Acceptable Manufacturers and Products:

   a. No Substitute

B. Requirements:

1. Provide interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; ~~cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.~~

2.14 KEYING

A. Scheduled System:

1. Existing factory registered system:

a. Provide cylinders/cores **0-Bitted for** Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28.

B. Requirements:

1. Permanent Keying: Provided by Owner.

2.15 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:

a. **Provide by Owner**

2.16 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

a. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Through-bolt all wood door closers.

2.17 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. LCN 4600 series

2. Acceptable Manufacturers and Products:

   a. Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide hard-wired actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or

egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.18 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.19 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.20 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Sargent
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.21 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide overhead stops.

2.22 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

a. Zero International

2. Acceptable Manufacturers:

a. National Guard
b. Reese
c. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.

2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.23 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.24 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. LCN

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.25 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:

a. GE-Interlogix

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.26 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
2. Vandal Pulls: BHMA 630 (US32D)
3. Protection Plates: BHMA 630 (US32D)
4. Overhead Stops and Holders: BHMA 630 (US32D)
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
   4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

   1. Install construction cores to secure building and areas during construction period.
   2. Replace construction cores with permanent cores as indicated in keying section.
   3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

   1. Conduit, junction boxes and wire pulls.
   2. Connections to and from power supplies to electrified hardware.
   3. Connections to fire/smoke alarm system and smoke evacuation system.
   4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
   5. Connections to panel interface modules, controllers, and gateways.
   6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):
116A 116B 146

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	L9010 03A		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 02

For use on Door #(s):
135B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	EXIT LOCK	L9025 03A		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 03

For use on Door #(s):
110

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	EXIT LOCK	L9025 03A		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG.

Hardware Group No. 04

For use on Door #(s):
111 204 207 210 213 216
219

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CORRIDOR W/DEADBOLT & OUTSIDE INDICATOR	LV9456BDC 03A 09-544 OS-OCC		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 05

For use on Door #(s):

112	128	129	220	312	313
407	408				

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CORRIDOR W/DEADBOLT & OUTSIDE INDICATOR	LV9456BDC 03A 09-544 OS-OCC		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 06

For use on Door #(s):

152	160	161	162

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CORRIDOR W/DEADBOLT & OUTSIDE INDICATOR	LV9456BDC 03A 09-544 OS-OCC		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA SRI TBSRT - PUSH-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 07

For use on Door #(s):

159

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CORRIDOR W/DEADBOLT & OUTSIDE INDICATOR	LV9456BDC 03A 09-544 OS-OCC		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP SCUSH SRI TBSRT		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 08

For use on Door #(s):

113 148 149 150 403

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 09

For use on Door #(s):

114 164

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	OH STOP	100S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 10

For use on Door #(s):

135D

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBSRT		689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 11

For use on Door #(s):
158 163

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 12

For use on Door #(s):
153

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 13

For use on Door #(s):
157

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 14

For use on Door #(s):
143 144

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBSRT		689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 15

For use on Door #(s):
133

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBSRT		689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
1	EA	ARMOR PLATE	8402 36" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 16

For use on Door #(s):
119

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 17

For use on Door #(s):
132

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	ARMOR PLATE	8402 36" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 18

For use on Door #(s):
404

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 19

For use on Door #(s):
137

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB (AS REQ'D)		689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	ZER

Hardware Group No. 20

For use on Door #(s):
138B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	AUTO FLUSH BOLT	FB31P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	LV9070BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB (AS REQ'D)		689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	ZER

Hardware Group No. 21

For use on Door #(s):
126 130 221 223 309 406

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	LV9080BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 22

For use on Door #(s):
120B 124 310 311 405

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	LV9080BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 23

For use on Door #(s):
123A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	AUTO FLUSH BOLT	FB31P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	LV9080BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB (AS REQ'D)		689	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
2	EA	ARMOR PLATE	8402 36" X 1" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	ZER

Hardware Group No. 24

For use on Door #(s):
222

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	LV9080BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 25

For use on Door #(s):
120A 131

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	LV9080BDC 03A		626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB (AS REQ'D)		689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	ZER

Hardware Group No. 26

For use on Door #(s):
118 155A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA - G DOOR TYPE ONLY		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 27

For use on Door #(s):
138A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBSRT		689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	SET	GASKETING	870AA-S		AA	ZER
1	EA	DOOR BOTTOM	364AA-Z49		AA	ZER
1	EA	THRESHOLD	164A		A	ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 28

For use on Door #(s):

115B	125	140	147	303	304
305	306	307	308	411	412
413	414	415	416		

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR	626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER		BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA - G & N8 DOOR TYPES ONLY	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS		VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 29

For use on Door #(s):
115A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 30

For use on Door #(s):
108A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	EU MORTISE LOCK	LV9092BDCEU 03A RX CON		✓	626	SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
1	EA	ELECTRIC STRIKE	6211AL FSE CON		✓	630	VON
1	EA	OH STOP	100S			630	GLY
1	EA	SURF. AUTO OPERATOR	4631		✓	689	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T		✓	630	LCN
2	EA	SURFACE MOUNT BOX	8310-819S				LCN
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM ELECTRIC STRIKE TO POWER SUPPLY		✓		SCH
1	EA	INTERCOM SYSTEM	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
2	EA	DESK MOUNT BUTTON	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	POWER SUPPLY	PS902 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) POWER SUPPLY SHARED WITH DOORS 108B AND 117.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING A VALID CREDENTIAL TO THE READER OR PRESSING DESK MOUNT BUTTON LOCATED AT RECEPTION DESK WILL MOMENTARILY UNLOCK THE ELECTRIFIED TRIM ALLOWING ACCESS AND MOMENTARILY ENABLE THE EXTERIOR ACTUATOR BUTTON. PUSHING THE ENABLED EXTERIOR ACTUATOR BUTTON WILL MOMENTARILY UNLOCK THE ELECTRIC STRIKE AND CAUSE THE AUTOMATIC OPERATOR TO MOMENTARILY OPEN THE DOOR. THE INTERIOR ACTUATOR BUTTON TO BE ENABLED AT ALL TIMES. PUSHING THE INTERIOR ACTUATOR BUTTON WILL MOMENTARILY UNLOCK THE ELECTRIC STRIKE AND CAUSE THE AUTOMATIC OPERATOR TO MOMENTARILY OPEN THE DOOR. THE REQUEST TO EXIT FEATURE OF THE LOCK TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 31

For use on Door #(s):
108B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	224XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	EU MORTISE LOCK	LV9095BDCEU 03A RX CON		✓	626	SCH
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE			689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CVX			630	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
2	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	PUSH TO ENTER BUTTON	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
2	EA	DESK MOUNT BUTTON	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON

NOTES:
1) POWER SUPPLY LISTED WITH DOOR 108A.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

UNLOCKED HOURS: DOOR NORMALLY CLOSED AND LOCKED AND PUSH TO ENTER BUTTON ON SCHOOL CORRIDOR SIDE SHALL BE ENABLED VIA ACCESS CONTROL SYSTEM. PRESSING PUSH TO ENTER BUTTON ON SCHOOL CORRIDOR SIDE WILL MOMENTARILY UNLOCK THE ELECTRIFIED TRIM ALLOWING ACCESS FROM SCHOOL CORRIDOR INTO OFFICE. OFFICE SIDE ALWAYS LOCKED PREVENTING FREE PASSAGE FROM OFFICE INTO THE SCHOOL. PRESENTING A VALID CREDENTIAL TO THE READER ON SCHOOL OFFICE SIDE, OR PRESSING DESK MOUNT BUTTON LOCATED AT RECEPTION DESK, WILL MOMENTARILY UNLOCK THE ELECTRIFIED TRIM ALLOWING ACCESS FROM OFFICE INTO SCHOOL.

LOCKED HOURS: DOOR NORMALLY CLOSED AND LOCKED AND PUSH TO ENTER BUTTON ON SCHOOL CORRIDOR SIDE SHALL BE DISABLED VIA ACCESS CONTROL SYSTEM, THUS LOCKED IN BOTH DIRECTIONS. PRESENTING A VALID CREDENTIAL TO THE READER ON EITHER SIDE OR PRESSING DESK MOUNT BUTTON LOCATED AT RECEPTION DESK, WILL MOMENTARILY UNLOCK THE ELECTRIFIED TRIM ALLOWING ACCESS.

THE REQUEST TO EXIT FEATURE OF THE LOCK TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS).

Hardware Group No. 32

For use on Door #(s):
117

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	INSTITUTION LOCK	LV9082BDC 03A		626	SCH
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	ELECTRIC STRIKE	6211 FSE CON		630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM ELECTRIC STRIKE TO POWER SUPPLY			SCH
2	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR			
1	EA	DOOR CONTACT	1076D-G		GRY	SEN
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) POWER SUPPLY LISTED WITH DOOR 108A.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO EITHER READER WILL MOMENTARILY UNLOCK THE ELECTRIC STRIKE ALLOWING ACCESS/EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS).

Hardware Group No. 33

For use on Door #(s):
154

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PULL-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 34

For use on Door #(s):
180

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP EDA SRI		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 35

For use on Door #(s):
181A 181B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	✓	689	VON
2	EA	MANUAL FLUSH BOLT	FB458		626	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR	✓	626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	OH STOP & HOLDER	100H		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 36

For use on Door #(s):
102C 102D

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	DUMMY PUSH BAR	350		626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

Hardware Group No. 37

For use on Door #(s):
151B 202B 205B 208B 211B 214A
217A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 38

For use on Door #(s):
156B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
2	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7850 (COORDINATE VOLTAGE AS REQ'D)	✓	689	LCN
2	EA	SILENCER	SR64		GRY	IVE

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

ALL WIRING AND CONDUIT BY ELECTRICAL CONTRACTOR. COORDINATE ALL WIRING AND INSTALLATION WITH ELECTRICAL AND SECURITY CONTRACTORS.

DOORS NORMALLY HELD OPEN BY MAGNETIC HOLD OPENS. MAGNETIC HOLD OPENS ARE WIRED TO THE LOCKDOWN SYSTEM. WHEN SYSTEM IS ACTIVATED, THE MAGNETS RELEASE, AND THE DOORS CLOSE AND LOCK. DOORS CAN ALSO BE MANUALLY RELEASED FROM THE MAGNETS.

Hardware Group No. 39

For use on Door #(s):
121A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-03		626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)		626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488S		BK	ZER

Hardware Group No. 40

For use on Door #(s):

151A 202A 205A 208A 211A 214B
217B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT - PUSH-SIDE		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 41

For use on Door #(s):
156A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7850 (COORDINATE VOLTAGE AS REQ'D)		689	LCN
3	EA	SILENCER	SR64		GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

ALL WIRING AND CONDUIT BY ELECTRICAL CONTRACTOR. COORDINATE ALL WIRING AND INSTALLATION WITH ELECTRICAL AND SECURITY CONTRACTORS.

DOOR NORMALLY HELD OPEN BY MAGNETIC HOLD OPEN. MAGNETIC HOLD OPEN IS WIRED TO THE LOCKDOWN SYSTEM. WHEN SYSTEM IS ACTIVATED, THE MAGNET RELEASES, AND THE DOOR CLOSES AND LOCKS. DOOR CAN ALSO BE MANUALLY RELEASED FROM THE MAGNET.

WHEN DOOR IS CLOSED AND LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 42

For use on Door #(s):
141A 145A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
2	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR		626	SCE
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
2	EA	SILENCER	SR64		GRY	IVE
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR			
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 43

For use on Door #(s):
139A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	✓	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
2	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR	✓	626	SCE
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	MEETING STILE	8217S		BK	ZER
1	SET	GASKETING	870AA-S		AA	ZER
2	EA	DOOR BOTTOM	364AA-Z49		AA	ZER
1	EA	THRESHOLD	164A		A	ZER
2	EA	MOUNTING BRACKET	870SPB			ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 44

For use on Door #(s):
139B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	✓	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
2	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR	✓	626	SCE
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MEETING STILE	8217S		BK	ZER
1	SET	GASKETING	870AA-S		AA	ZER
2	EA	DOOR BOTTOM	364AA-Z49		AA	ZER
1	EA	THRESHOLD	164A		A	ZER
2	EA	MOUNTING BRACKET	870SPB			ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 45

For use on Door #(s):
136A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10	✓	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB		689	VON
2	EA	FIRE EXIT HARDWARE	98-EO-F		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-70-MT-TLR-B - PROVIDED BY ACCESS CONTROL CONTRACTOR	✓	626	SCE
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	SURFACE CLOSER	4040XP EDA TBSRT		689	LCN
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7850 (COORDINATE VOLTAGE AS REQ'D)	✓	689	LCN
1	EA	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	ZER
		PIBS/POWER SUPPLY	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON

NOTES:
1) ACCESS CONTROLS CONTRACTOR TO COORDINATE DOOR AND FRAME PREP WITH HARDWARE CONTRACTOR.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

THE WALL MAGNET SHALL BE WIRED TO THE FIRE ALARM PANEL THROUGH A SET OF NORMALLY-CLOSED, DRY CONTACTS (SUPPLIED BY THE FIRE ALARM CONTRACTOR) AND TIED TO LOCKDOWN SYSTEM.

DOOR NORMALLY HELD OPEN BY MAGNETIC HOLD OPEN. MAGNETIC HOLD OPEN IS WIRED TO THE FIRE ALARM AND LOCKDOWN SYSTEM. WHEN SYSTEM IS ACTIVATED, THE MAGNET RELEASES, AND THE DOOR CLOSES AND LOCKS. DOOR CAN ALSO BE MANUALLY RELEASED FROM THE MAGNET.

WHEN DOOR IS CLOSED AND LOCKSET IS NORMALLY SECURE. PRESENTING VALID CREDENTIAL TO CARD READER WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY. LOCKDOWN AND DOOR MONITORING FUNCTIONALITY TO BE PROGRAMMED BY THE ACCESS CONTROL CONTRACTOR AND COORDINATED WITH OWNER PRIOR TO INSTALLATION. FREE EGRESS AT ALL TIMES.

Hardware Group No. 46

For use on Door #(s):
100E 101D

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-110MD-CON		✓	626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)			626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
1	EA	DOOR PULL	VR914 NL			630	IVE
1	EA	OH STOP	100S			630	GLY
1	EA	SURF. AUTO OPERATOR	4642		✓	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T		✓	630	LCN
2	EA	SURFACE MOUNT BOX	8310-867S				LCN
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	INTERCOM SYSTEM	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	POWER SUPPLY	PS906 900-4RL 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) POWER SUPPLY FOR DOOR 100E SHARED WITH DOORS 100F, 100G, AND 100H.
2) POWER SUPPLY FOR DOOR 100D SHARED WITH DOORS 100A, 100B, AND 100C.
3) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE. PUSHING EITHER AUTO OPERATOR ACTUATOR WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 47

For use on Door #(s):

200C 300C 400D

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-110MD-CON		626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)		626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	DOOR PULL	VR914 NL		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	4642		689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T		630	LCN
2	EA	SURFACE MOUNT BOX	8310-867S			LCN
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)			SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY			SCH
1	EA	INTERCOM SYSTEM	PROVIDED BY ACCESS CONTROL CONTRACTOR			
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR			
1	EA	DOOR CONTACT	1076D-G		GRY	SEN
1	EA	POWER SUPPLY	PS902 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER			VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) POWER SUPPLY FOR DOOR 200C SHARED WITH DOOR 200D.
2) POWER SUPPLY FOR DOOR 300C SHARED WITH DOOR 300D.
3) POWER SUPPLY FOR DOOR 400D SHARED WITH DOOR 400C.
4) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE. PUSHING EITHER AUTO OPERATOR ACTUATOR WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 48

For use on Door #(s):

100F	100G	100H	101A	101B	101C
200D	300D	400C			

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON	✓	626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)	✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY	✓		SCH
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) POWER SUPPLY FOR DOORS 100F, 100G, AND 100H LISTED WITH DOOR 100E.
2) POWER SUPPLY FOR DOORS 100A, 100B, AND 100C LISTED WITH DOOR 100D.
3) POWER SUPPLY FOR DOOR 200D LISTED WITH DOOR 200C.
4) POWER SUPPLY FOR DOOR 300D LISTED WITH DOOR 300C.
5) POWER SUPPLY FOR DOOR 400C LISTED WITH DOOR 400D.
6) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS..

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 49

For use on Door #(s):
100A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-110MD-CON		✓	626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)			626	BES
1	EA	SFIC CONST CORE	80-035 (AS REQ'D)				SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
1	EA	DOOR PULL	VR914 NL			630	IVE
1	EA	OH STOP	100S			630	GLY
1	EA	SURF. AUTO OPERATOR	4642		✓	689	LCN
1	EA	WEATHER RING	8310-801				LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T		✓	630	LCN
2	EA	SURFACE MOUNT BOX	8310-867S				LCN
1	EA	DOOR SWEEP	8192AA			AA	ZER
1	EA	THRESHOLD	655A			A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	INTERCOM SYSTEM	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	POWER SUPPLY	PS906 900-4RL 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) POWER SUPPLY FOR DOOR 100A SHARED WITH DOORS 100B, 100C, AND 100D.
2) POWER SUPPLY FOR DOOR 101H SHARED WITH DOORS 101E, 101F, AND 101G.
3) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE. PUSHING EITHER AUTO OPERATOR ACTUATOR WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 50

For use on Door #(s):

200A 300A 400A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-110MD-CON		626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)		626	BES
1	EA	SFIC CONST CORE	80-035 (AS REQ'D)			SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
1	EA	DOOR PULL	VR914 NL		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	4642		689	LCN
1	EA	WEATHER RING	8310-801			LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T		630	LCN
2	EA	SURFACE MOUNT BOX	8310-867S			LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)			SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY			SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR			
1	EA	DOOR CONTACT	1076D-G		GRY	SEN
1	EA	POWER SUPPLY	PS902 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER			VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) POWER SUPPLY FOR DOOR 200A SHARED WITH DOOR 200B.
2) POWER SUPPLY FOR DOOR 300A SHARED WITH DOOR 300B.
3) POWER SUPPLY FOR DOOR 400A SHARED WITH DOOR 400B.
4) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE. PUSHING EITHER AUTO OPERATOR ACTUATOR WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 51

For use on Door #(s):
101H

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-110MD-CON		✓	626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)			626	BES
1	EA	SFIC CONST CORE	80-035 (AS REQ'D)				SCH
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
1	EA	DOOR PULL	VR914 NL			630	IVE
1	EA	OH STOP	100S			630	GLY
1	EA	SURF. AUTO OPERATOR	4642		✓	689	LCN
1	EA	WEATHER RING	8310-801				LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T		✓	630	LCN
2	EA	SURFACE MOUNT BOX	8310-867S				LCN
1	EA	DOOR SWEEP	8192AA			AA	ZER
1	EA	THRESHOLD	655A			A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
1	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	POWER SUPPLY	PS906 900-4RL 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) POWER SUPPLY SHARED WITH DOORS 101E, 101F, AND 101G.
3) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE. PUSHING EITHER AUTO OPERATOR ACTUATOR WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 52

For use on Door #(s):

100B	100C	100D	101E	101F	101G
200B	300B	400B			

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON	✓	626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)	✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY	✓		SCH
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) POWER SUPPLY FOR DOORS 100B, 100C, AND 100D LISTED WITH DOOR 100A.
2) POWER SUPPLY FOR DOORS 101E, 101F, AND 101G LISTED WITH DOOR 101H.
3) POWER SUPPLY FOR DOOR 200B LISTED WITH DOOR 200A.
4) POWER SUPPLY FOR DOOR 300B LISTED WITH DOOR 300A.
5) POWER SUPPLY FOR DOOR 400B LISTED WITH DOOR 400A.
6) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM.

DEVICE IS ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN FOR CERTAIN TIMES OF THE DAY VIA THE ACCESS CONTROL SYSTEM, THUS IN PUSH/PULL MODE.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 53

For use on Door #(s):

102A 201B 302B 402A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON	✓	626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)	✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY	✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
1	EA	POWER SUPPLY	PS902 900-2RS - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER	✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH ALLOWING ACCESS. THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 54

For use on Door #(s):
136D 136F

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON	✓	626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)	✓		SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY	✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) POWER SUPPLY LISTED WITH DOOR 136C.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH ALLOWING ACCESS. THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. DOOR TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 55

For use on Door #(s):
136C

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	CONT. HINGE	112XY EPT			628	IVE
2	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB			689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-CON		✓	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON		✓	626	VON
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)			626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
2	EA	DOOR PULL	VR914 DT			630	IVE
2	EA	OH STOP	100S			630	GLY
2	EA	SURFACE CLOSER	4040XP EDA			689	LCN
2	EA	BLADE STOP SPACER	4040XP-61			689	LCN
1	EA	MULLION SEAL	8780N			BK	ZER
2	EA	DOOR SWEEP	8192AA			AA	ZER
1	EA	THRESHOLD	655A			A	ZER
2	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
2	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
2	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	POWER SUPPLY	PS904 900-4RL - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) POWER SUPPLY SHARED WITH DOORS 136D AND 136F.
2) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOORS NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH ALLOWING ACCESS. THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACTS MONITOR WHETHER THE DOORS ARE OPENED, CLOSED OR HELD OPEN TOO LONG. DOORS TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 56

For use on Door #(s):
156D

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	CONT. HINGE	112XY EPT			628	IVE
2	EA	POWER TRANSFER	EPT10 CON		✓	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB			689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-CON		✓	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON		✓	626	VON
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)			626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER				BES
2	EA	DOOR PULL	VR914 DT			630	IVE
2	EA	OH STOP	100S			630	GLY
2	EA	SURFACE CLOSER	4040XP EDA			689	LCN
2	EA	BLADE STOP SPACER	4040XP-61			689	LCN
1	EA	MULLION SEAL	8780N			BK	ZER
2	EA	DOOR SWEEP	8192AA			AA	ZER
1	EA	THRESHOLD	655A			A	ZER
2	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)		✓		SCH
2	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY		✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR		✓		
2	EA	DOOR CONTACT	1076D-G		✓	GRY	SEN
1	EA	POWER SUPPLY	PS902 900-2RS - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER		✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS				VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER				

NOTES:
1) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOORS NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH ALLOWING ACCESS. THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACTS MONITOR WHETHER THE DOORS ARE OPENED, CLOSED OR HELD OPEN TOO LONG. DOORS TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 57

For use on Door #(s):
123B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	ELEC PANIC HARDWARE	RX-9849-EO-CON	✓	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-EO-CON	✓	626	VON
2	EA	DOOR PULL	VR914 DT		630	IVE
2	EA	OH STOP & HOLDER	100H		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	BLADE STOP SPACER	4040XP-61		689	LCN
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A-V3		A	ZER
2	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)	✓		SCH
2	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY	✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
1	EA	POWER SUPPLY	PS902 900-2RS - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER	✓		VON
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOORS NORMALLY CLOSED AND LOCKED VIA ACCESS CONTROL SYSTEM. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH ALLOWING ACCESS. THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACTS DURING VALID EGRESS. DOOR CONTACTS MONITOR WHETHER THE DOORS ARE OPENED, CLOSED OR HELD OPEN TOO LONG. DOORS TO REMAIN LOCKED UPON LOSS OF POWER OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 58

For use on Door #(s):

102B 136E 136G 201A 302A 402B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-CON		626	VON
1	EA	DOOR PULL	VR914 DT		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA - FG2 DOOR TYPE ONLY		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XX/XXP (AS REQ'D) - ELECTRIFIED HARDWARE TO POWER TRANSFER (EVALUATE CONDITIONS AND MODIFY WIRE LENGTH AS REQ'D)			SCH
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM POWER TRANSFER TO POWER SUPPLY			SCH
1	EA	DOOR CONTACT	1076D-G		GRY	SEN
		WIRING DIAGRAMS	ELEVATION & POINT-TO-POINT DIAGRAMS			VON
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

NOTES:
1) RELATED TRADES TO REFER TO WIRING DIAGRAM TO ACCOUNT FOR CONDUCTOR COUNTS, WIRE GAUGE, AND ROUGH-IN LOCATIONS.

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

THE REQUEST TO EXIT FEATURE OF THE DEVICE TO SHUNT THE ALARM OUTPUT OF THE DOOR CONTACT DURING VALID EGRESS. DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG. FREE EGRESS AT ALL TIMES.

Hardware Group No. 59

For use on Door #(s):

121B 139C 139D 141B 145B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61		689	LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR CONTACT MONITORS WHETHER THE DOOR IS OPENED, CLOSED OR HELD OPEN TOO LONG.

Hardware Group No. 60

For use on Door #(s):

156E

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	MULLION	FIXED MULLION			
2	EA	PANIC HARDWARE	LD-98-EO		626	VON
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	BLADE STOP SPACER	4040XP-61		689	LCN
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
2	EA	DOOR CONTACT	1076D-G	✓	GRY	SEN
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

DOOR CONTACTS MONITOR WHETHER THE DOORS ARE OPENED, CLOSED OR HELD OPEN TOO LONG.

Hardware Group No. 61

For use on Door #(s):
135A 135C 135E 136B

Each to have:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 62

For use on Door #(s):
155B

Each to have:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		HARDWARE BY DOOR MANUFACTURER		

END OF SECTION 087100

SECTION 088000
GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Glazed entrances.
3. Interior borrowed lites.
4. Storefront framing.
5. Fire-rated glazing.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames" for installation of glazing.
2. Division 08 Section "Flush Wood Doors" for installation of glazing.
3. Division 08 Section "Aluminum Framed Entrance and Storefronts" for glazing.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

G. Fire-Protective Glazing: Glazing capable of confining a fire for a prescribed period of time stated in minutes when tested per NFPA 252 and NFPA 257.

H. Fire-Resistive Glazing: Glazing capable of preventing or retarding the passage of excessive heat, hot gases or flames for a prescribed period of time stated in minutes when tested per ASTM E119.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

c. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.

1) Load Duration: 30 days.

d. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat treated to resist wind loads.
2) For insulating glass.
3) For laminated-glass lites.

e. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
b. Solar Heat Gain Coefficient: NFRC 200.
c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass, and insulating glass.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

F. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and local codes.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

2.3 FIRE-RATED GLAZING PRODUCTS (FRG)

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Monolithic Ceramic Glazing: Proprietary Category II Safety Glazing Products in the form of clear, ceramic flat glass; 1/4-inch nominal thickness.

1. Basis-of-Design products: Subject to compliance with requirements, provide one of the following:

a. Safti First; SuperLite II-XL (3/4”) for 45 minute rating.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements and Kind FT (fully tempered) float glass.

2.10 TEMPERED GLAZING TYPES

A. Class I (clear), fully tempered float glass, ¼ inch nominal thickness.

1. Provide safety glazing labeling.

2.11 FIRE PROTECTED RATED GLAZING TYPES

A. 45 minute fire rated glazing without hose-stream test; monolithic ceramic glazing.

1. Provide safety glazing labeling. (Cat II).
2. Fully Tempered

2.12 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Low-E-Coated, Tinted Insulating Glass Type:
   a. Basis-of-Design Product: Guardian SN 68 on CrystalGray
   b. Overall Unit Thickness: 1 inch.

c. Minimum Thickness of Each Glass Lite: 6 mm.
d. Outdoor Lite: Tinted heat-strengthened float glass.
e. Interspace Content: Argon.
f. Indoor Lite: Clear heat-strengthened float glass.
g. Low-E Coating: Pyrolytic on second surface.
h. Safety glazing required.

2. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
3. Perimeter Spacer: Polypropylene-covered stainless steel in color selected by Architect.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Saint-Gobain Glass Corp.
      2) Technoform Glass Insulation North America.
      3) Thermix; a brand of Ensinger USA.
4. Desiccant: Molecular sieve or silica gel, or a blend of both.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or

other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 MIRROR INSTALLATION

A. Mount mirrors accurately in place in a manner that avoids distorting reflected images. Maintain a space of approximately 1/8 inch between back of mirrors and mounting surface for air circulation.

B. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:
   a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
   b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
   c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.9 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 088700
ARCHITECTURAL WINDOW FILMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Safety and security film.

1.2 RELATED SECTIONS

A. Section 088000 - Glazing

1.3 REFERENCES

A. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

B. ASTM International (ASTM):

1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

2. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

3. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

4. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

5. ASTM D1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).

6. ASTM D2240 - Standard Method for Rubber Property - Durometer Hardness.

7. ASTM D2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.

8. ASTM E84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.

9. ASTM E903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

D. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

E. Underwriters Laboratories Inc. (UL): UL 972 - Burglary Resisting Glazing Material.

1.4 PERFORMANCE REQUIREMENTS

A. Safety Glazing Impact Performance:
   1. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
   2. Impact Resistance after Aging: 400 ft-lbs, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/8 inch annealed glass.

B. Impact Resistance and Pressure Cycling:
   1. ASTM E1996 / E1886: Large Missile "C", +/- 75 psf Design Pressure

C. Tear Resistance:
   1. Minimum Graves Area Tear Strength of 1,200 lbs% as measured on coated film product, without liner, per ASTM D1004.

D. Adhesion to Glass:
   1. Minimum 6 lbs/in peel strength per ASTM D3330 (Method A).

E. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
   1. Flame Spread Index: no greater than 25.
   2. Smoke Developed Index: no greater than 55.

F. Abrasion Resistance:
   1. Film shall have a surface coating that is resistant to abrasion such that less than 3 percent increase of transmitted light haze will result when tested in accordance to ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

G. UV Light Rejection:
   1. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.

1.5 SUBMITTALS

A. Product Data: Manufacturer’s current technical literature on each product to be used, including:

   1.1 Manufacturer's Data Sheets.
   1.2 Preparation instructions and recommendations.

1.3 Installation methods.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
   1. Provide documentation that the adhesive used on the specified films is a Pressure Sensitive Adhesive (PSA).

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
   1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. 3M Commercial Solutions.
   2. LLumar.

B. Source Limitations: Obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General (Basis of Design):

   1. 3M Scotchsheild Ultra S800 Safety & Security Film.

B. Physical / Mechanical Performance Properties (nominal):
   a. Film Color: Clear.
   b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils
   c. Tensile Strength (ASTM D882):
      1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
      2) Coated Film: 32,000 psi (MD) / 32,000 psi (TD).
   d. Break Strength (ASTM D882):
      1) Base Film: 250 lb/in (MD) / 250 lb/in (TD).

2) Coated Film: 245 lb/in (MD) / 265 lb/in (TD).

e. Percent Elongation at Break (ASTM D882):
1) Base Film: 115 % (MD) / 115 % (TD).
2) Coated Film: 132 % (MD) / 130 % (TD).

f. Yield Strength:
1) Base Film: 12,000 psi (MD).
2) Coated Film: 15,000 psi (MD).

g. Percent Elongation at Yield (ASTM D882):
1) Base Film: 7% (MD).
2) Coated Film: 9% (MD).

h. Graves Tear Resistance (ASTM D1004):
1) Maximum Force (lbs):
a) Base Film: 40 (MD) / 40 (TD).
b) Coated Film: 40 (MD) / 40 (TD).
2) Maximum Extension (in):
a) Base Film: 0.45 (MD) / 0.65 (TD).
b) Coated Film: 0.50 (MD) / 0.57 (TD).
3) Graves Area Tear Resistance (lbs%):
a) Base Film: 1,100 (MD) / 1,300 (TD).
b) Coated Film: 1,100 (MD) / 1,300 (TD).

i. Puncture Propagation Tear Resistance (ASTM D2582):
1) Coated Film: 9 lbf (MD) / 10 lbf (TD).

j. Puncture Strength (ASTM D4830):
1) Material Properties (as supplied).
2) Coated Film: 185 lbf.

C. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.

D. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.

E. Identification: Labeled as to Manufacturer as listed in this Section.

F. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass.
a. Visible Light Transmission (ASTM E 903): 87 percent.
b. Visible Reflection (ASTM E 903): Not more than 10 percent.
c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
d. Solar Heat Gain Coefficient (ASTM E 903): 0.79

H. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.

I. Forced Entry Resistance: Product shall have been evaluated for time to resist complete body passage by a qualified 3rd Party test lab.

2.3 EXAMINATION

A. Film Examination:
1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
2. Do not proceed with installation until glass surfaces have been properly prepared and

deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.

3. Commencement of installation constitutes acceptance of conditions

2.4 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Adhesive or Impact Protection Profile film attachment systems.

2.5 INSTALLATION

A. Film Installation, General:
   1. Install in accordance with manufacturer's instructions.
   2. Cut film edges neatly and square at a uniform distance of 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
   3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
   4. Apply film to glass and lightly spray film with slip solution.
   5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
   6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
   7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
   8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

2.6 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 088700

SECTION 089119
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

B. Related Sections:

1. Division 23 Sections for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type:

a. Exterior: Tube framed unless otherwise indicated.
b. Interior: Tube unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide subsills made of same material as louvers or extended sills for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Air Balance Inc.; a Mestek company.
   b. Air Flow Company, Inc.
   c. Airolite Company, LLC (The).
   d. All-Lite Architectural Products.
   e. American Warming and Ventilating, Inc.; a Mestek company.
   f. Arrow United Industries; a division of Mestek, Inc.
   g. Carnes Company, Inc.
   h. Cesco Products; a division of Mestek, Inc.
   i. Construction Specialties, Inc.
   j. Dowco Products Group; Safe-Air of Illinois, Inc.
   k. Greenheck Fan Corporation.
   l. Industrial Louvers, Inc.
   m. Louvers & Dampers, Inc.; a division of Mestek, Inc.
   n. Metal Form Manufacturing Inc.
   o. NCA Manufacturing, Inc.
   p. Nystrom Building Products.
   q. Reliable Products, Inc.
   r. Ruskin Company; Tomkins PLC.
   s. United Enertech Corp.
   t. Vent Products Company, Inc.

2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades locate 8’-0” or less above grade and 0.060 inch for blades located over 8’-0” above grade.
4. Louver Performance Ratings:

   a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
   b. Point of Beginning Water Penetration: Not less than 900 fpm.
   c. Air Performance: Not more than 0.10-inch wg static pressure drop at 500-fpm free-area intake velocity.
   d. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area exhaust velocity.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening except where insect screening is indicated.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Mill finish unless otherwise indicated.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.
2. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 inches (50 mm).
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
3. Insulating Core: Extruded-polystyrene foam.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels with clips or sheet metal screws.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to **5** times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, chemical anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Acoustical Spring isolation Hangers: See drawings for type and locations.

D. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

E. Wind Uplift Braces: Provide rigid uplift braces or hangers as required.

F. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

G. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of minimum 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches or as required for spans and wind uplift.

H. Furring Channels (Furring Members) for Exterior Soffits:

1. Cold-Rolled Channels: Minimum 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 1/2 inch deep. Hat shaped.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: Minimum 20 gauge.
b. Depth: As indicated on Drawings and as required for spans.

I. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch.
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire Trak Corp.; Fire Trak System.
b. Grace Construction Products; FlameSafe FlowTrak System.
c. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch.
2. Depth: As indicated on Drawings.

F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
c. Tile backing panels: 16 inches o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900
GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
2. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
4. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Material Compliance Certificate: Submit completed Material Compliance Certificate as described in Specification Section 013300 – Architect's Submittal Procedures.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum; Firebloc Type C.
b. CertainTeed Corp.; ProRoc Type C.
c. Georgia-Pacific Gypsum LLC; Fireguard C.
d. Lafarge North America Inc.; Firecheck Type C.
e. National Gypsum Company; Gold Bond Fire-Shield C.
f. USG Corporation; Firecode C Core.

B. Regular Type:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

E. High-Impact Type: Manufactured with Type X moisture resistant core fiberglass reinforced for greater resistance to through-penetration (impact resistance).

1. Core: 5/8 inch thick.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:

1. Complying with ASTM C 1178/C 1178M.

a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.

2. Complying with ASTM C1177/C 1177M.

a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.

3. Core: 5/8 inch, Type X.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. U-Bead: J-shaped; exposed short flange does not receive joint compound.
c. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

E. Joint Compound for Exterior Applications:

1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: As indicated on Drawings.
2. Type X: Where required for fire-resistance-rated assembly.
3. Abuse-Resistant Type: All wall surfaces from floor to 8’-0” above finished floor and all ceilings below 9’-0” above finished floor unless noted as high-impact location. See partition types for additional locations.
4. High-Impact Type: Storage rooms, non-tile toilet room walls and all corridor walls from floor to 8’-0” above finished floor, Locker room ceilings, and as indicated on Drawings.
5. Moisture- and Mold-Resistant Type: Ceilings in Toilet rooms, shower areas, janitor closets, kitchen areas, and as indicated on Drawings. Walls in janitor closets, kitchen areas, and as indicated on drawings.
6. Combination wall boards: Provide combination of Type-X, moisture resistant, abuse resistant and impact resistant where more than one requirement is listed for a use.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. U-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile and Panels that are substrate for acoustical tile and Where indicated on Drawings.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013
CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Porcelain Wall tile
2. Mosaic Floor Tile
3. Metal edge strips
4. Metal Transitions.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Face Size: Actual tile size, excluding spacer lugs.

D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
   1. CHIP-size units of each type and composition of tile and for each color and finish required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product.

C. Product Test Reports: For tile-setting and -grouting products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
   2. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

A. Porcelain Tile Type **CTF-1**: Floor Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Essential
3. Tile Size: 1.4” by 1.4” Mosaic
4. Finish: Matte
5. Tile Color, Glaze, and Pattern: Grey
6. Transition from Floor tile to Wall tile: Schluter®-DILEX-AHK
7. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

B. Porcelain Tile Type **CTW-1**: Field Wall Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Essential
3. Tile Size: 24 by 24 inches
4. Face: Rectified
5. Finish: Matte
6. Tile Color, Glaze, and Pattern: Grey
7. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

C. Tile Type **CTW-2**: Accent Wall Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Hustle - Shimmie
3. Color: Vogue
4. Finish: Matte
5. Size: 5/8” x 1-7/8”W
6. Sheet Size: 12” x 11.63”
7. Thickness: 6mm
8. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

D. Tile Type **CTW-3**: Accent Wall Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Hustle - Shimmie
3. Color: Fandago
4. Finish: Matte
5. Size: 5/8” x 1-7/8”W
6. Sheet Size: 12” x 11.63”
7. Thickness: 6mm
8. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

E. Tile Type **CTW-4**: Accent Wall Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Hustle - Shimmie
3. Color: Soul City
4. Finish: Matte
5. Size: 5/8” x 1-7/8”W
6. Sheet Size: 12” x 11.63”
7. Thickness: 6mm
8. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

F. Tile Type **CTW-5**: Accent Wall Tile. / BASIS OF DESIGN
1. Manufacturers: Beaver Tile & Stone
   a. Mary Hunt
   b. 248-675-5070
   c. mhunt@beavertile.com
2. Series: Hustle - Shimmie
3. Color: Bronx
4. Finish: Matte
5. Size: 5/8” x 1-7/8”W
6. Sheet Size: 12” x 11.63”
7. Thickness: 6mm
8. Grout Color: As indicated by manufacturer's designations.
   a. TEC/Accucolor DeLorean Gray #934

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Medium Bed): ANSI A118.4.
1. Manufacturers: Subject to compliance with requirements, provide the following:
   a. TEC; a subsidiary of H. B. Fuller Company; Ultimate Large Tile Mortar™. (Typical Floor Mortar)
      TEC; a subsidiary of H. B. Fuller Company: 3NI (Walls)

2. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

A. High Performance Grout: ANSI A118.7

1. Manufacturers: Subject to compliance with requirements, provide the following:

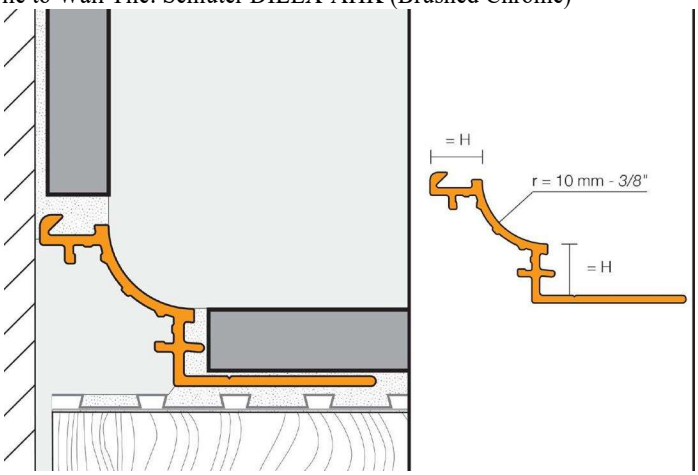
a. TEC; a subsidiary of H. B. Fuller Company; Power Grout

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Transitions and edge strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass exposed-edge material.

1. TR-1: Schluter Quadec-K (Acgb-Brushed Chrome) at Outside Edges Of Tile
2. TR-2: Schluter Dilex-Ahka (Acgb-Brushed Chrome) at Cove Btm Of Tile
3. TR-3: Schluter Reno-Ramp-K(Alum Satin) at Tile/Tarraflex To Epoxy
4. TR-4: Schluter Vinpro-U (Acgb-Brushed Chrome) at Resilient/Conc.
5. Floor Tile to Wall Tile: Schluter DILEX-AHK (Brushed Chrome)



C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile floors consisting of tiles 8 by 8 inches or larger.
   d. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Glazed Wall Tile: 1/16 inch.
   2. Porcelain Tile: 1/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thinset).

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation: TCNA F125; membrane, water-cleanable, high performance tile-setting; high performance grout.

    a. Ceramic Tile Type: CTF
    b. Grout: Water-cleanable high performance grout. / TEC Power Grout

B. Interior Wall Installations, Masonry or Concrete:

1. Ceramic Tile Installation: TCNA W211-15

    a. Ceramic Tile Type: CTW.
    b. Thinset Mortar: Modified latex Portland cement mortar.
    c. Grout: Water-cleanable high performance grout. / TEC Power Grout

C. Interior Wall Installations, Glass Mat Moisture-Resistant Gypsum Backer Board:

1. Ceramic Tile Installation: TCNA W248-15

    a. Ceramic Tile Type: CTW.
    b. Thinset Mortar: Modified latex Portland cement mortar.
    c. Grout: Water-cleanable high performance grout. / TEC Power Grout

END OF SECTION 093013

SECTION 095113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 450 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS **APC-1 (U.N.O)**

A. Basis-of-Design Product: Subject to compliance with requirements, provide:
1. USG Ceiling Solutions; **USG Millenia – High NRC #76705** Acoustical Panels or comparable product by one of the following:
   a. CertainTeed Corp.
   b. Armstrong World Industries, Inc.

B. Insert drawing designation for each product required. Use the same designation for the acoustical panels in this article and for the related suspension system in "Metal Suspension System" Article; together, they make up the ceiling assembly. Use these designations on Drawings to identify each ceiling assembly.

C. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

D. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured.

E. Color: White.

F. Light Reflectance (LR): Not less than 0.85.

G. Ceiling Attenuation Class (CAC): Not less than CAC indicated in a schedule 35.

H. Noise Reduction Coefficient (NRC): Not less than 0.70.

I. Edge/Joint Detail: Shadowline Tapered

J. Thickness: 3/4 inch.

K. Weight: 1.31 lbs/SF

L. Modular Size: 24 by 24 inches.

M. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 ACOUSTICAL PANELS **APC-2 (KITCHEN AND SERVERY)**

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong; Kitchen Zone #673** or comparable product by one of the following:

1. CertainTeed Corp.;
2. USG Interiors, Inc.; Subsidiary of USG Corporation.;

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IX, mineral base with painted finish; Form 2, water felted with soil resistant polyester film.
2. Pattern: G

C. Color: White.

D. LR: Not less than 0.89

E. NRC: N/A

F. CAC: Not less than 33

G. Edge/Joint Detail: Square.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 24 inches.

J. Sag Warranty: 30 years.

K. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. Rockfon (Rockwool International)
   3. USG Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

   1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

C. Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch-wide aluminum caps on flanges.

   1. Structural Classification: Intermediate-duty system.
   2. Face Design: Flat, flush.
   3. Cap Finish: Painted white.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

E. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees. / At all vestibule locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.
b. Install panels with pattern running in one direction parallel to long axis of space.

c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. See Division 9 “Ceramic Tiling” Specification for metal transitions.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product with selected color(s) indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg For more than 95 deg F in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.6 RESILIENT WALL BASE SCHEDULE

A. Resilient Wall Base **(RB-1)**: Where this designation is indicated, provide the following:

1. Product: Roppe
2. Color & Pattern: 150 Dark Grey
3. Type (ASTM F 1861): Type TV (vinyl, thermoplastic)
4. Group: Group 2 (solid, layer)
5. Style: Cove (with top set toe)
6. Minimum Thickness: 0.125 inches
7. Height: 4 inches
8. Lengths: Coils in manufacturer’s standard length
9. Outside Corners: Job formed
10. Inside Corners: Job formed

11. Finish: Satin, Smooth.

END OF SECTION 096513

SECTION 096516
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Unbacked vinyl sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F , in spaces to receive resilient sheet flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 UNBACKED VINYL SHEET FLOORING **(PROTECT ALL)**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Protect-All: Oscoda Plastics®, Inc.

B. Product Standard: ASTM F 1913.

C. Protect-All sheets in 5’ x 8’ or 5’ x 5’ in ¼" thickness with color chosen from manufacturer's samples in matte finish.

D. Protect-All 2-part epoxy flooring adhesives.

E. Protect-All cove base system with a minimum height of 6".

1. Protect-All Rapid Weld™ or corner rod for the cove base system.

F. Protect-All Rapid Weld or V-Rod for floor seams.

G. Protect-All aluminum or stainless steel cove base cap (Z-bar).

H. Protect-All stainless steel drain rings, corner guards, and transition strips as provided by Oscoda Plastics.

I. Protect-All stainless steel fasteners and anchors for drain rings, corner guards, and transition strips

J. Protect-All E-6100 sealant.

K. Other installation materials as required and supplied by Protect-All.

L. Sheet Width: As standard with manufacturer.

M. Seamless-Installation Method: Chemically bonded.

N. Colors and Pattern: Dark Grey

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Seamless-Installation Accessories:

1. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Seamless Installation:

1. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 1 / Unit Pricing specification for moisture mediation.

1.2 SUMMARY

A. Section Includes:

1. Luxury vinyl tile.

1.3 Related Requirements:

Section 096513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

2. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive LVT.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 72 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE **(LVT-#)**

1. Interface
   a. Manufacturer's Rep:
      1) Charles Timmerman
      2) Email: Chuck.Timmerman@interface.com
      3) Mobile: 616-481-1719

B. Northern Grain: **LVT-1**

1. Product: Northern Grain
2. Color: Oak Satin
3. Product Number: A02611
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Plank
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing: Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 25 cm x 1 m (9.845 in x 39.38 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Ashlar

C. Walk On By: **LVT-2**

1. Product: Look Both Ways Collection
2. Color: Royal Blue
3. Product Number: A01507
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 50 cm x 50 cm (19.69 in x 19.69 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Non Directional

D. Studio Set: **LVT-3**

1. Product: Studio Set
2. Color: Royal Blue
3. Product Number: A00720
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 25 cm x 1 m (9.845 in x 39.38 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Ashlar

E. Walk On By: **LVT-4**

1. Product: Look Both Ways Collection
2. Color: Orange
3. Product Number: A01504
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 50 cm x 50 cm (19.69 in x 19.69 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Non Directional

F. Studio Set: **LVT-5**
1. Product: Studio Set
2. Color: Orange
3. Product Number: A00716
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 25 cm x 1 m (9.845 in x 39.38 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Ashlar

G. Walk On By: **LVT-6**
1. Product: Look Both Ways Collection
2. Color: Dark Green
3. Product Number: A01508
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 50 cm x 50 cm (19.69 in x 19.69 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Non Directional

H. Studio Set: **LVT-7**
1. Product: Studio Set
2. Color: Electric Blue
3. Product Number: A00721
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™

10. Nominal Dimensions: 25 cm x 1 m (9.845 in x 39.38 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Ashlar

I. Walk On By: **LVT-8**
1. Product: Look Both Ways Collection
2. Color: Violet
3. Product Number: A01506
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 50 cm x 50 cm (19.69 in x 19.69 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Non Directional

J. Studio Set: **LVT-9**
1. Product: Studio Set
2. Color: Violet
3. Product Number: A00719
4. Product Construction: High Performance Luxury Vinyl Tile
5. Class / ASTM F1700 Class III Printed Vinyl Tile
6. Wear Layer Thickness: 22 mil
7. Total Thickness: 4.5 mm
8. Backing Class Commercial Grade
9. Finish: Ceramor™
10. Nominal Dimensions: 25 cm x 1 m (9.845 in x 39.38 in)
11. Warranty: 15 year Standard LVT Warranty
12. Installation: Ashlar

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Commercialon® Premium Modular/LVT Pressure Sensitive Adhesive, a premium modular flooring adhesive specifically formulated for bonding J+J Flooring's Luxury Vinyl Tile to the floor
1. Adhesives shall comply with the following limits for VOC content:
   a. Composition Tile Adhesives: 50 g/L or less.
2. Adhesives shall be manufacturer's recommended for 5 lbs and water/1000 sq. ft.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

2. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive flooring.

3. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

4. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

5. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by manufacturer and adhesive materials manufacturer.

6. Verify that required floor-mounted utilities are in correct location.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
1. Coordinate building expansion joint trim with flooring.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

2. See Color Layout plans for details.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated on color layout drawings.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
1. Install at base cabinet interior without toe kicks.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between

pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096566
RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet vinyl resilient athletic flooring

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D 543 Standard Practices for Evaluating Resistance to Chemical Reagents

2. ASTM E 648: Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using A Radiant Heat Energy Source.

3. ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

4. ASTM F 970: Standard Test Method for Static Load Limit.

5. ASTM E 1155: Standard Test Method for Determining FF (Floor Flatness) and FL (Floor Levelness) Numbers.

6. ASTM F 1516: Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method.

7. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

8. ASTM F 2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

9. ASTM F 2772: Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems.

10. ASTM D5116: Standard for Determination of Organic Emissions From Indoor Materials/Products.

B. American Concrete Institute (ACI):

1. ACI 302.2R: ACI Guide for Concrete Slabs That Receive Moisture-Sensitive Flooring Materials.

C. DIN (German Institute for Standardization):

1. DIN V18032: Sport Halls - Halls For Gymnastics, Games and Multi-Purpose Use Part 2: Floors For Sporting Activities, Requirements, Testing.

1.3 RELATED SECTIONS:

A. Specification Section 012200 Unit Pricing for Moisture Mediation as required.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Manufacturer Certifications:

1. For ISO 9001 manufacture.

2. For ISO 14001 manufacture.

C. Laboratory Test Results:

1. Shock absorption (force reduction) test results certified by an independent testing laboratory certified to perform such testing.

a. ASTM test must be from certified North American laboratories.

2. Fire performance results.

D. Shop Drawings: Showing installation details and locations of borders, patterns, game lines, locations of floor inserts and seams.

E. Samples:

1. One sample not less than 6 inches by 8 inches for each type of flooring indicated

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For a qualified resilient athletic flooring Manufacturer.

2. For a qualified resilient athletic flooring Installer.

1.6 CLOSEOUT SUBMITTALS

A. Submit three copies of the following:

1. Manufacturer maintenance instructions.

2. Manufacturer material warranty.

3. Installer installation warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. ISO 9001 Certified.

2. ISO 14001 Certified.

3. At least ten years active experience in the manufacture and marketing of indoor resilient athletic flooring.

4. A provider of authorized installer training.

B. Installer Qualifications:

1. At least five years experience in the installation of resilient athletic flooring.

2. Experience on at least five projects of similar size, type and complexity as this Project.

3. Employer of workers for this Project who are competent in techniques required by manufacturer for resilient athletic flooring installation indicated.

C. Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.

D. Athletic Performance Properties: Comply with ASTM F 2772 Performance Level **C2** for force reduction and ball rebound.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (13 deg C) nor more than 85 deg F (29 deg C).

B. Store the indoor resilient athletic surfacing rolls in an upright position on a smooth flat surface immediately upon delivery to Project.

1.9 FIELD CONDITIONS

A. Product Installation:

1. Maintain temperatures during installation within range recommended by manufacturer, but not less than 65 deg F (18 deg C) in spaces to receive flooring one week before installation, during installation, and one week after installation.

2. After installation, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

3. Prohibit traffic during flooring installation and for at least 48 hours after flooring installation.

B. Install flooring only after other finishing work, including painting and overhead work, has been completed.

1.10 WARRANTY

A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.

1. Material warranty direct from the product manufacture and not a separate or third party insurance provider.

2. Failures include, but are not limited to, the following:

a. Material manufacturing defects.

b. Surface wear and deterioration to the point of wear-through.

c. Failure due to substrate moisture exposure not exceeding 15 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 92 percent relative humidity when tested according to ASTM F 2170.

3. Warranty Period:

a. For materials: 2 years from date of Substantial Completion.

b. For surface wear: **15 years from date of Substantial Completion.**

c. For moisture vapor tolerance not exceeding 15 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 92 percent relative humidity when tested according to ASTM F 2170: 10 years from date of Substantial Completion.

B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.11 COORDINATION

A. Coordinate layout and installation of flooring with other gymnasium equipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Low Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SHEET VINYL ATHLETIC FLOORING (**RAF-1)**

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Gerflor **Taraflex Multi Use 6.2** (6.2) Sports Flooring.

B. Substitution Limitations:

1. Approval by Architect of other manufacturers does not relieve Contractor of responsibility to provide products which comply with all requirements of this Section.

C. Description: Dual durometer foam-backed sheet vinyl flooring designed for adhered athletic flooring applications.

1. Overall Thickness: Not less than 0.24 inch (6.2 mm).

2. Wear-Layer Thickness: Not less than 0.08 inch (2.1 mm)

3. Backing: Very high density, dual durometer, closed cell foam with reinforced fiberglass grid.
   a. Equal to CXPHD+

4. Seaming Method: Heat welded.

5. Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance and Solid colors to have “pebbled” embossed texture for an attractive appearance.

6. Bacteriostatic and Fungicidal Treatment: Manufacturer’s factory-applied permanent treatment

   a. Basis-of-Design Product: Gerflor Sanosol

7. Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.

   a. Basis-of-Design Product: Gerflor Protecsol.

8. Roll Size: Not less than 4.92 feet wide by longest length practical to minimize splicing during installation but in no case less than 86 feet, 6 inches (26.4 m) in length

   a. Roll length shall be sufficient to cover the full length of the court (as depicted on the drawings) without splicing or end-of-roll (butt) seams within main court boundary.

9. Field-Applied Finishes: None required and not allowed.

10. Color and Pattern:

    a. Type **RAF-1 #6381 MAPLE DESIGN**
       1) Wood pattern shall accurately simulate the true visual appearance of natural athletic wood strip flooring. Pattern shall replicate random-length stock by simulating non-uniform board lengths ranging from 18 inches to 48 inches (457 mm to 1219 mm) with a maximum board width of 2-1/2 inches (63.5 mm). Wood pattern shall not include a dark line simulating edges or ends of individual boards. Surface texture shall simulate realistic wood grain and not be raised or "pebbled" embossing.

    b. Type **RAF-2 #6430 BLUE**

    c. Court lines: **Reference A8.1**

D. Performance Criteria:

1. Shock Absorption/Force Reduction:

   a. ASTM F 2772; Pass/Class C2.
   b. EN 14808; Pass, 32 percent.
   c. DIN-18032; 35 percent.

2. Ball Bounce:

   a. ASTM F 2772; Pass, Greater than or equal to 90 percent.
   b. EN 12235; Pass, Greater than or equal to 90 percent.
   c. DIN-18032; Pass, Greater than or equal to 90 percent.

3. Sliding/Coefficient of Friction:

   a. EN 13036; Pass.
   b. DIN-18032; Pass.

4. Vertical Deformation:

   a. EN 14809; Pass.
   b. DIN 18032; Pass

5. Static Load Limit/Indentation Resistance:

   a. ASTM F 970; Pass, Less than or equal to 0.005 inch. at 250p.s.i.
   b. EN 1516; Pass, Less than or equal to 0.5 mm.

6. Resistance to Rolling Load:

    a. EN 1569; Pass.
    b. DIN-18032; Pass.

7. Chemical Resistance:

    a. ASTM D 543; OK.
    b. EN 423; OK.

8. Impact Resistance: EN 1517; Pass.

9. Impact Resistance: Impact Protection Index: 52%

10. Area Deflection: DIN-18032; 0 percent.

11. Abrasion Resistance: EN ISO 5470; Pass.

12. Sound Insulation: EN ISO 717; 18 dB.

13. Gloss/Brightness: EN ISO 2813; Pass.

14. Organic Emission: ASTM D 5116; Pass

15. Fire Performance: ASTM E 648; Greater than 0.45 W/cm2, Class 1.

16. Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.

17. Slab Moisture Design Tolerance: Maximum moisture vapor emission rate of 15 pounds of water per 1000 sq. ft. (33 kg of water per 92.9 sq. m) in 24 hours when tested according to ASTM F1869.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by athletic flooring manufacturer.

B. Adhesives: Water-resistant type recommended by athletic flooring manufacturer for substrate and conditions indicated.

    1. Basis-of-Design Product: Gerflor Gerpur.

        a. Moisture Resistance: 15 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 92 percent relative humidity when tested according to ASTM F 2170.
        b. Coverage Type: Formulated for full-spread application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the Following:

1. The area in which the indoor resilient athletic flooring will be installed is dry, weather-tight and in compliance with specified requirements.

2. Permanent heat, lighting and ventilation systems are installed and operable.

3. Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.

4. No foreign materials or objects are present on the substrate and that it is clean and ready for preparation and installation.

5. Tests to verify that the moisture evaporative rate or substrate relative humidity is within the specified ranges.

6. The concrete slab surface pH level is within the specified range.

7. The concrete slab surface deviation is no greater than 1/8 inch within 10 feet (3.2 mm within 3 m) when measured according to ASTM E 1155.

8. The concrete slab complies with ACI 302.2R for concrete design including use of a low-permeance vapor barrier directly beneath the concrete subfloor with sealed penetrations.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure proper adhesion of resilient athletic flooring system.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of sealers, curing compounds and other additives. Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.

2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are between 7.0 and 8.5.

3. Relative Humidity: Concrete slab must not exceed 95% in accordance with ASTM F2170.

C. Moisture Testing: Perform calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission **rate acceptable in writing by manufacturer.**

D. Use trowelable concrete based leveling and patching compound with the same moisture vapor tolerance as the adhesive to fill depressions, holes, cracks, grooves or other irregularities in substrate.

E. Place flooring and installation materials into spaces where they will be installed at least 48 hours before installation. Install flooring materials only after they have reached the same temperature as space where they are to be installed.

F. Sand the surface of the concrete slab.

G. Sweep and then vacuum substrates immediately before installation. After cleaning, examine substrate for moisture, alkaline salts, grit, dust or other contamination. Proceed with installation only after unsatisfactory conditions have been corrected.

H. Confirm that concrete has a smooth finish, proper density and is highly compacted with a tolerance of 1/8th of an inch in a 10 foot radius.

3.3 SHEET ATHLETIC FLOORING INSTALLATION

A. General:

1. Comply with resilient athletic flooring manufacturer's installation instructions.
2. Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.
3. Fit flooring neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
4. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

B. Lay out flooring as follows:

1. Minimize number of seams and place them in inconspicuous areas.
2. Locate seams as shown on approved Shop Drawings

C. Adhered Flooring: Attach products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturer instructions.

D. Vinyl Sheet Flooring Seams: Finish seams to produce surfaces flush with adjoining flooring surfaces. Comply with ASTM F 1516. Rout joints and use heat welding rod to permanently and seamlessly fuse sections together.

3.4 CLEANING AND PROTECTION

A. Perform the following operations after completing resilient athletic flooring installation:

1. Remove marks and blemishes from flooring surfaces.
2. Sweep and then vacuum flooring.
3. Damp-mop flooring to remove soiling.

B. Protect flooring from abrasions, indentations, and other damage from subsequent operations and placement of equipment, during remainder of construction period.

END OF SECTION 096566

SECTION 096723
RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resinous flooring systems.
   a. Moisture barrier as approved for system. Unit cost per square foot.
2. Related Sections:
   a. Section 079200 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference per Division 1 specifications.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: 6” x 6” sample for each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

D. Data on concrete moisture levels and alkalinity testing.

1.5 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: For each resinous flooring component, from manufacturer.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   1. Installer to have a minimum of 5 years' experience installing the specified systems.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Apply full-thickness mockups on 100 SF floor area selected by Architect for each system.

   2. Simulate finished lighting conditions for Architect's review of mockups.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 48 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of Design: Sherwin Williams/
2. Stonehard
3. Sika
4. Architect's Pre-approved equal.

2.2 MATERIALS

A. VOC Content of Liquid-Applied Flooring Components: Mot more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers

2.3 HIGH-PERFORMANCE RESINOUS FLOORING **REF-1**

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Manufacturer: **Chips Unlimited**
2. Color and Pattern: As indicated by product designation listed above.
3. Wearing Surface: Orange-peel texture. Mock-up required.
4. Overall System Thickness: 1/8 inch.
5. Federal Agency Approvals: USDA approved for food processing environments.

C. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Application Method: Self-leveling slurry with broadcast aggregates.

a. Thickness of Coats: 1/8 inch.
b. Primer: Standard pigmented primer #3579 / Sherwin Williams
c. Body Coat: Self-leveling Epoxy #3745 Sherwin Williams base color tinted.
d. Decorative vinyl chip aggregate.
e. Grout Coat: #3745 2 coats.
f. Seal Coat: Polycoat Urethane top finish #4685 UV stabilized top coat required.

4. Aggregates: Vinyl flakes.

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   1. Flexural Modulus of Elasticity: 10,000 per ASTM C 580.
   2. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
   3. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch per MIL-D-3134.
   4. Flammability: Self-extinguishing per ASTM D 635.
   5. Bond Strength: 300 psi, 100 percent concrete failure per ACI 503R.
   6. UV Light Reflectance: Good (QUV)

E. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion in the following reagents for no fewer than seven days:

F. Decorative Flake:
   1. Snowbound 7004-31%
   2. Passive 7064-31%
   3. Iron Ore 7069-38%
   4. Image for reference:

2.4 ACCESSORIES

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

   1. Formulation Description: 100 percent solids.

B. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.

   1. Formulation Description: 100 percent solids.

C. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with ASTM C811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft of slab area in 24 hours.
b. Plastic Sheet Test: ASTM D4263. Proceed with application only after testing indicates absence of moisture in substrates.
c. Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing, as approved by manufacture.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 INSTALLATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.

D. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.

E. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.3 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal the flooring system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.
   1. Provide thermal break between freezer and kitchen.

3.5 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

B. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

C. Areas of inconsistent applications of decorative flake will be replaced at Owner’s discretion

3.6 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096813
TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Walk-Off carpet
   2. Carpet tile at Music Room

B. Related Requirements:

   1. Section 096513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include manufacturer's written installation recommendations for each type of substrate.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 10 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE **WALK-OFF CARPET (AT VESTIBULE LOCATIONS)**

A. Interface
1. Pattern: Step Repeat Collection
2. Color: 104940 Iron
3. Backing: GlasBac
4. Manufacturer's Rep:
a. Charles Timmerman
b. Email: Chuck.Timmerman@interface.com
c. Mobile: 616-481-1719

B. Product Number: 1388602500

C. Product Construction: Tufted Textured

D. Loop Yarn System: 100% Recycled Content Nylon

E. Yarn Manufacturer: Aqual

F. Dye Method: 100% Solution Dyed

G. Preservative Protection: InterSept®

H. Tufted Yarn Weight: 26 oz/yd²

I. Machine Gauge: 1/12

J. Pile Height: 0.20 in

K. Pile Thickness: 0.14 in

L. Stitches: 10.00 /in

M. Pile Density: 6,545 oz/yd³

N. Size: 19.69 in x 19.69 in

O. Adhesive: Manufacture Standard

P. Flooring Radiant Panel: (ASTM E-648) Passes

Q. Smoke Density: (ASTM E-662) ≤ 450

R. Flammability Passes Methenamine Pill Test (DOC-FF1-70)

S. Lightfastness (AATCC 16 - E) ≥ 4.0 @ 60 AFU's

T. Static (AATCC - 134) < 3.0 KV

U. Installation Method: Monolithic

V. Warranty: 15 year Standard

2.2 CARPET TILE – MUSIC ROOM

A. JJ Flooring
   1. Pattern: Network Modular - Kinetex
   2. Color: 2910 Maze
   3. Backing: Polyester Felt Cushion
   4. Manufacturer's Rep:
      a. Nichole Lee
      b. Email: nichole.lee@jjflooring.com
      c. Mobile: 1-616-295-4132

B. Construction: Textile Composite

C. Dye: Method Solution Dyed

D. Wear Layer: Polyester - Applied Pattern

E. Total Weight: 4.5 oz - 5.2 oz/ square foot

F. Total Thickness: .205 inches

G. Dimensions: 24" x 24" modules

H. Standard Adhesive: Kinetex Adhesive

I. Packaging: 18 modules per box (72 sq.ft)

J. Standard Warranties: Kinetex Adhesive

K. Optional Warranties: PreFix

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft.in 24 hours.
   b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inchwide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200
WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vinyl wall covering – Digital Print Mural

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

1. Wall-Covering Strike office for color confirmation. Allow for (2) Separate Strike-Offs.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at

levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 265 NFPA 286.

2.2 VINYL WALL COVERING

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Surface Materials
   a. Manufacturer’s Rep: Ryan Scorr
   b. 248-910-5518
   c. ryans@surfacematerials.com

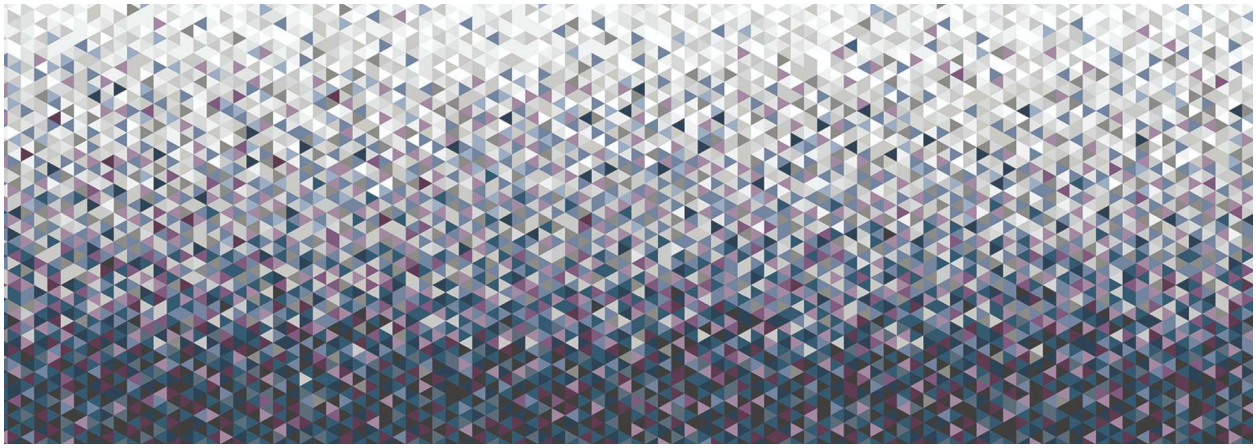
B. Description: Provide vinyl products in rolls from same production run and complying with the following:

1. FS CCC-W-408D and Wallcovering Association's W-101 for Type II, Medium Duty.
2. ASTM F793/F793M for strippable wall coverings.
   a. Category: V, Type II, Commercial Serviceability (Vinyl Coated) .

C. WC-1 (MAIN BUILDING)

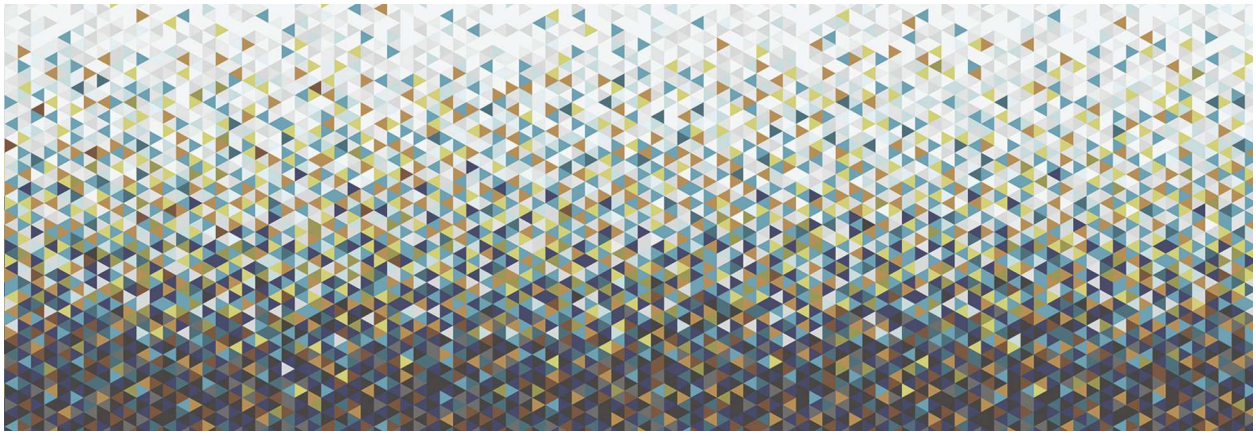
1. Design: Confetti # L11-0302
2. Color: Blueberry
3. Category Mural Design
4. Scale Rating: Infinite
5. Repeat Type: 2-Way Horizontal
6. Color Type: Solid

7. Installation Method: Straight hang
8. Image for reference:



D. WC-2 (PODS)

1. Design: Confetti # L11-0301
2. Color: Carnival
3. Category Mural Design
4. Scale Rating: Infinite
5. Repeat Type: 2-Way Horizontal
6. Color Type: Solid
7. Installation Method: Straight hang
8. Image for reference:



2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining , strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended in writing by wall-covering manufacturer that are directly adhered to CMU walls.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL LINER

A. Install wall liner, without gaps or overlaps. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried. **(With WC-1 @ CMU Wall)**

3.4 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.5 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 098433
SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes back mounted acoustical panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panel edge, core material, and mounting indicated.

B. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric facing from sound-absorbing wall unit manufacturer's full range.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by sound-absorbing wall units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 or NFPA 286.

C. Preinstallation Conference: Conduct conference at Project site per to comply with requirements in Division 1 Section “Project Management and Coordination.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install sound-absorbing wall units until a lighting level of not less than 50 fc is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

   a. Acoustical performance.
   b. Warping of core.

2. Warranty Period: (30) Years from date of substantial completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNIT SCHEDULE (**AWP-#)**

A. Back-Mounted, Edge-Reinforced, Acoustical Wall Panels

1. Products: Equal to Tectum: Designart
2. Surface Texture: Coarse
3. Composition: Aspen wood Fiber bonded with inorganic hydraulic cement.
4. Color: Varies per panel. Reference Sheet A1.9 for color selections
5. Panel Sizes: 24”x24”. Reference Sheet A1.9 for color selections
6. Thickness: 2”
7. Edge profile: Square
8. Shape: Square, Triangle, Circle
9. Flame Spread: ASTM E; (Fire Class A)

2.2 FABRICATION

A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

C. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, with base-support bracket system where recommended by manufacturer for additional support of panels, and as follows:

1. As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch.

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 098436
SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
   1. Sound-absorbing baffle panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.

   1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
   2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.

C. Samples for Initial Selection: For each type of fabric facing.

   1. Include Samples of hardware and accessories involving color or finish selection.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets.
2. Suspended ceiling components above ceiling units.
3. Structural members to which suspension devices will be attached.
4. Items penetrating or covered by units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain ceiling units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

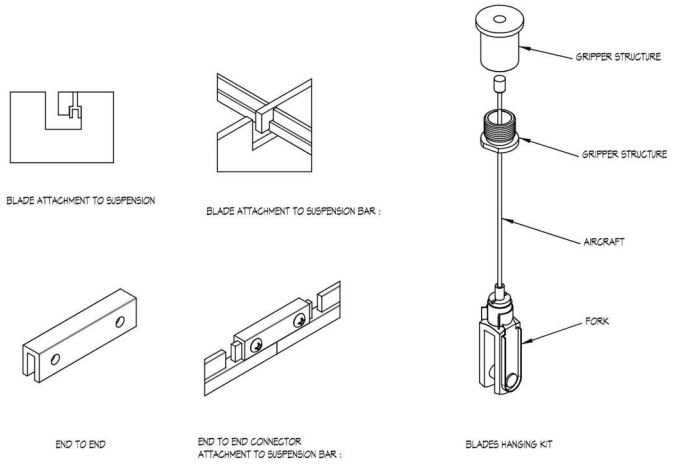
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

B. Sound-Absorbing Baffle Panel (**PROFILE-#**): Manufacturer's standard panel construction consisting of homogeneous baffle material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Basis of Design: Armstrong, Fletworks Blade Ceilings; Baffle System.
1. Distributed By Armstrong
2. Panel Shape: **Angled**
3. Mounting: Top-edge mounted with manufacturer's standard **suspension system**.
a. Square Tube Suspension System, anodized aluminum.
b. Cable Kit – length as required for installation
c. Unistrut as required. Coordinate with mechanical contractor.

d. General Image of Product (for reference only)



4. Core: Manufacturer's standard
5. Edge Construction: Manufacturer's standard chemically hardened core with no frame
6. Corner Detail in Elevation: Square.
7. Acoustical Performance: Sound absorption NRC 0.85
8. Nominal Baffle Thickness: 3/8 inch
9. Baffle Height: Varies per baffle. Reference Sheet A5.4.
10. System Size: Varies per building. Reference Sheet A5.4.
11. Color: Varies per baffle. Reference Sheet A5.4.

2.3 MATERIALS

A. Core Materials: Manufacturer's standard.

B. Facing Material: Monolithic Baffle Material from same dye lot; color and pattern as selected by Architect from manufacturer's full range

C. Mounting Devices: Concealed on back or top edge of unit, recommended by manufacturer to support weight of unit.

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Measure each area and establish layout of panels and joints of indicated on Drawings within a given area.

C. Edge Hardening: Chemically harden core edges and areas of core where mounting devices are attached.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation from Level or Slope: Plus or minus 1/8 inch

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

SECTION 099124
INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Galvanized metal.
3. Gypsum board.
4. Cotton or canvas insulation covering.
5. ASJ insulation covering.

B. Related Requirements:

1. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
2. Section 099600 "High-Performance Coatings" for tile-like coatings.
3. See Mechanical Sheet GHX1.32 for geo piping painting.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each Sample for location and application area.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    1. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    2. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
    1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Process documentation: time stamped photos of each layer of the system at application to document the primer, intermediate coat and topcoat have all been applied.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Paints.
3. Pratt & Lambert.
4. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: See Schedule at the end of Part 3 .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.
3. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer [.] but not less than the following:

1. SSPC-SP 7/NACE No. 4.
2. SSPC-SP 11.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
    1. Equipment, including panelboards and switch gear.
    2. Uninsulated metal piping.
    3. Uninsulated plastic piping.
    4. Pipe hangers and supports.
    5. Metal conduit.
    6. Plastic conduit.
    7. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
    1. Equipment, including panelboards.
    2. Uninsulated metal piping.
    3. Uninsulated plastic piping.
    4. Pipe hangers and supports.
    5. Metal conduit.
    6. Plastic conduit.
    7. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    8. Other items as directed by Architect.
    9. .
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Water-Based Dry-Fall System , MPI INT 5.1CC:
    1. Prime Coat: Primer, alkyd, anticorrosive, for metal , MPI #79.
    2. Topcoat: Dry fall, latex, flat , MPI #118.
    3. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1) , MPI #133.

B. Gypsum Board Substrates:

1. High-Performance Architectural Latex System , MPI INT 9.2B:
    1. Prime Coat: Primer sealer, latex, interior , MPI #50.
    2. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    3. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2) , MPI #138.

C. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings .

1. Latex System , MPI INT 10.1B:
    1. Prime Coat: Primer sealer, latex, interior.
        1) MPI # 17 (PER MPI 2020)
    2. Intermediate Coat: Alkyd, interior, matching topcoat.
    3. Topcoat: Latex, interior, flat (MPI Gloss Level 1).
        1) MPI # 53

3.6 INTERIOR PAINTING SCHEDULE RELATED TO LOCATION

1. Gypsum Ceiling & Bulkheads; High Performance Architectural Latex (Satin) MPI #138 (Gloss Level 2).
2. Exposed Metal Ceilings; Waterborne Dry Fall MPI #118 & MPI #133. (Do not paint galvanized mechanical ducts where noted).

3. Walls; See Specification 099600 High Performance Coatings for Epoxy Paint.
4. Steel Door and Borrowed Light Frames, Metal Railing, and Columns; See Specification 099600 High Performance Coatings for Epoxy Paint.
5. Sealed Concrete Floors; See Section 3 Specifications.

3.7 INTERIOR PAINT COLOR SCHEUDLE

1. Interior Paint **P-1**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   b. Color: 7004 Snowbound

2. Interior Paint **P-2**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   Color: 7073 Icy

3. Interior Paint **P-3**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   b. Color: 6538 Dignified

4. Interior Paint **P-4**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   b. Color: 6626 Sunset

5. Interior Paint **P-5**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   b. Color: 6886 Invigorate

6. Interior Paint **P-6**: Where this paint color designation is indicated; provide the following:
   a. Manufacturer: To match Sherwin Williams
   b. Color: 9144 Moonmist

7. Interior Paint **P-7**: Where this paint color designation is indicated; provide the following:
   c. Manufacturer: To match Sherwin Williams
   d. Color: 6959 Blue Chip

8. Interior Paint **P-8** Where this paint color designation is indicated; provide the following:
   e. Manufacturer: To match Sherwin Williams
   Color: 7067 Cityscape

9. Interior Paint **P-9**: Where this paint color designation is indicated; provide the following:
   f. Manufacturer: To match Sherwin Williams
   g. Color: 6832 Impulsive Purple

10. Interior Paint **P-10** Where this paint color designation is indicated; provide the following:
    h. Manufacturer: To match Sherwin Williams
    i. Color: 6549 Ash Violet

11. Interior Paint **P-11**: Where this paint color designation is indicated; provide the following:
    a. Manufacturer: Approved Manufacturer
    b. Color: 7064 Passive

END OF SECTION 099124

SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates
   a. Steel
2. Interior Substrates:
   a. Concrete masonry units (CMUs).
   b. Steel.
   c. Galvanized metal.
   d. Gypsum board.

1.3 DEFINITIONS

A. MPI Gloss Level 3: 10-25 at 60 degrees, according to ASTM D523

B. MPI Gloss Level 4:20-35 at 60 degrees, according to ASTM D523

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each coat of each Sample.

3. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Coronado Paint; Benjamin Moore & Co.
3. O'LEARY.
4. PPG Paints.
5. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.
4. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 4000 to 10,000 psi at 6 to 12 inches.
2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.

E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 6/NACE No. 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over Epoxy Zinc-Rich Primer and High-Build Epoxy System MPI EXT 5.1G:
   a. Prime Coat: Primer ,zinc rich, epoxy, MPI #20
   b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108
   c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:

1. Epoxy-Modified Latex System MPI INT 4.2K :
   a. Block Filler: Block filler, latex, interior/exterior , MPI #4.
   b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
   c. Topcoat: Waterbased Light Industrial Coating (MPI Gloss Level 3), MPI #151

B. Steel Substrates:

1. Water Based Light Industrial Coating MPI INT 5.1N:
   a. Prime Coat: Primer, Epoxy, Anti-corrosive, for metal MPI #101.
   b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
   c. Topcoat: Waterbased Light Industrial Coating (MPI Gloss Level 3), MPI #151

C. Galvanized-Metal Substrates: (NON-CHROMATE PASSIVATED)

1. Water Based Light Industrial Coating MPI INT 5.3K:
   a. Prime Coat: Primer, water-based galvanized, MPI #134.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Waterbased Light Industrial Coating (MPI Gloss Level 3), MPI #151

D. Gypsum Board Substrates:

1. Water Based Light Industrial Coating MPI INT 9.2L:
   a. Prime Coat: Primer sealer, latex, interior , MPI #50.
   b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
   c. Topcoat: Waterbased Light Industrial Coating (MPI Gloss Level 3), MPI #151

3.8 EXTERIOR COLOR SCHEDULE

A. Exterior Paint HP-1: Where this paint color designation is indicated; provide the following:

1. Manufacturer: Equal to Sherwin Williams
2. Color: To match 7067 Cityscape

END OF SECTION 099600

SECTION 101100
VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Visual display board assemblies.
2. Velcro Wallcovering
3. Glass markerboards

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Provide data on surface materials.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLY **VDB**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CIG-JAN Products, Ltd.
2. Claridge Products and Equipment, Inc.
3. Egan Visual, Inc.
4. Marsh Industries, Inc.
5. PolyVision Corporation
6. Architect’s pre-approved equal.

B. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Markerboard.
2. Corners: Square
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to Wall / Mechanical Method. No Adhesive.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

F. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.

G. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.

1. Size: 2 inches high by length indicated on Drawings.
2. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
3. Flag Holder: One for each room.
4. Magnetic Marker Cup: White
5. Tackboard Insert Color: To Match Forbo Bulletin Board #2182 Potato Skin
6. Aluminum Color: Match finish of visual display assembly trim.

2.3 VELCRO WALL COVERING

A. Velcro wall covering:

1. Manufacturer: Momentum; D.L. Couch: AcoustiCord – Wall Carpet
   a. Substitutions: Not permitted
2. Color:
   a. 20 Rain – Unit 100
   b. 13 Pumpkin – Unit 200
   c. 14 Saphire – Unit 300
   d. 18 Wisteria – Unit 400
3. Width: 79”
4. Thickness: 0.2”
5. Weight: 60 oz/sq yd
6. Installation direction: Horizontal Rib

7. Adhesive: type recommended by wall covering manufacture to suit application to substrate.
8. Substrate Primer and sealer: water-base type recommended by wall covering manufacturer to suit application to substrate. Allows for easy removal of wall Covering
9. Accessories: J Cap Trim; 3/16" as needed; miter corners. Trim with manufactures recommended trim at all exposed edges.
10. Corners: Square
11. Width: As indicated on Drawings.
12. Height: As indicated on Drawings.
13. Mounting Method: Direct to Wall / Mechanical Method. No Adhesive.

2.4 MAGNETIC GLASS MARKERBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one the following:
1. Claridge Products and Equipment, Inc.; Equal
2. Clarus Glassboards, LLC.; FLOAT
3. Architect's Pre-Approved Equal

B. Glass Markerboards: Fabricated of ¼ inch tempered safety glass with steel backing for use with magnets.

1. Edge Treatment: Smooth polished edge with eased corners.
2. Frame: Aluminum trim in profile indicated.
3. Surface: Glossy
4. Color: To be selected from Manufacturer's Full Range (REFER TO SHEET A1.9 FOR ADDITIONAL COLOR NOTES)

C. Mounting: Concealed, Equal to Clarus TruMount System.

Trough: Yes

D. Size: As indicated on Drawings (REFER TO SHEET A1.9 FOR DETAILS)

E. Image for reference:

F.

2.5 ART DISPLAY

A. Manufacturer: Equal to Nova Display

B. Name: Acrylic Frameless Poster Display Kit

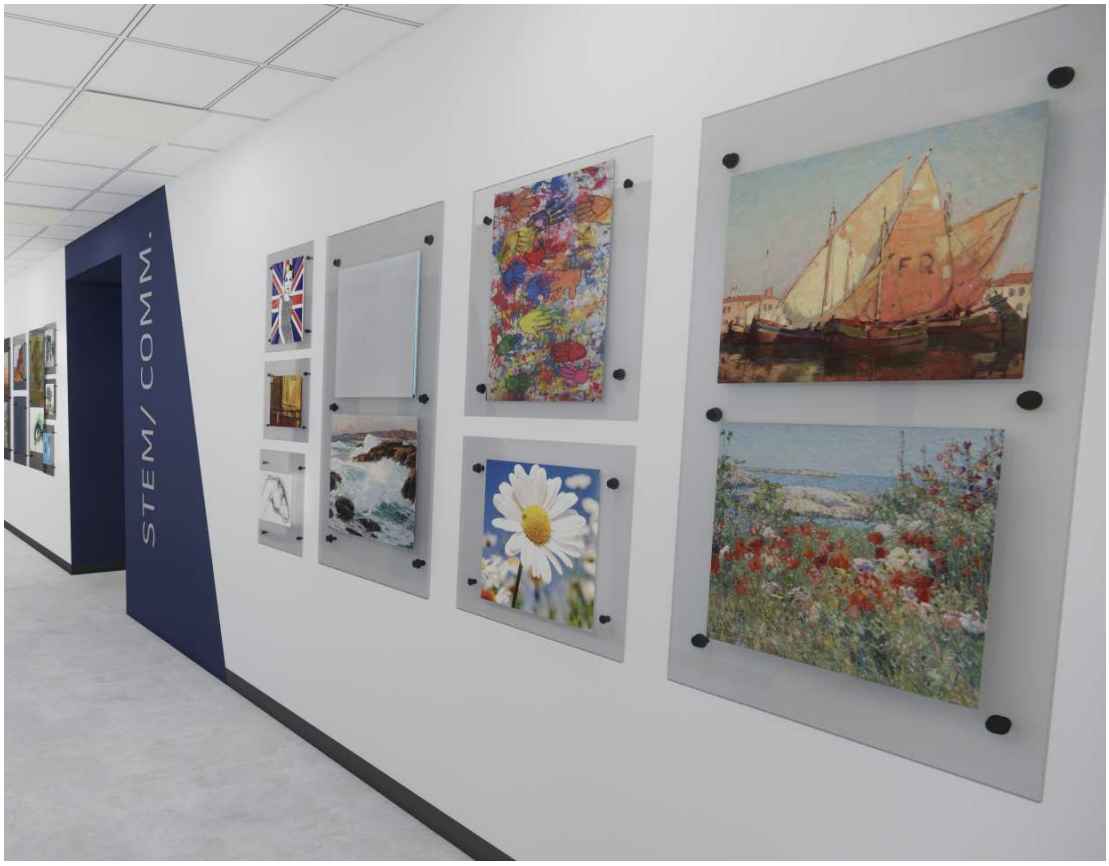
C. Size: REFER TO INTERIOR ELEVATIONS FOR SIZES

D. Color: Clear Acrylic

E. Mounting Hardware Color: Satin Chrome Finish

F. Installation per manufacturers written instructions. Provide hardware required.

G. Image for reference:

H. 

2.6 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
   1. Provide CeramaP3 or equal.

B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout.

C. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq.yd.; with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. Extruded Aluminum: ASTM B221, Alloy 6063.

G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

H. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Adhere to wall surfaces with egg-size adhesive gobs at 16 inches o.c., horizontally and vertically.

C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101416
PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal plaques.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each plaque.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Deterioration of embedded graphic image.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL PLAQUES

A. Cast Plaque : Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A.R.K. Ramos.
   b. ACE Sign Systems, Inc.
   c. Gemini Incorporated.
2. Plaque Material: Cast Brass
3. Plaque Thickness: 0.50 inch .
4. Finishes:
   a. Integral Metal Finish: As selected by Architect from full range of industry
   b. Overcoat: manufacture’s standard baked-on clear coating
5. Background Texture: Smooth .
6. Mounting: Rosette-head through fasteners
7. Integrally Cast Border Style: Projected beveled

2.2 MATERIALS

A. Brass casting: ASTM B584, alloy recommended by manufacturer and finisher for finish indicated.

B. Stainless- Steel Sheet: ASTM: ASTM A240/240M or ASTM A666, type 304 stretcher-leveled standard of flatness.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2.4 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

D. Reference sheet A1.10 for plaque design.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PLAQUES

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.\

D. Reference

END OF SECTION 101416-4

SECTION 101419
DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast dimensional characters.
   a. Interior Acrylic Dimensional Letters
   b. Exterior Dimensional Letters

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Exposed Accessories: Full-size Sample of each accessory type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS – INTERIOR ACRYLIC

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ACE Sign Systems, Inc.
b. A. R. K. Ramos Signage Systems.
c. ASI Sign Systems, Inc.
d. Gemini Incorporated.

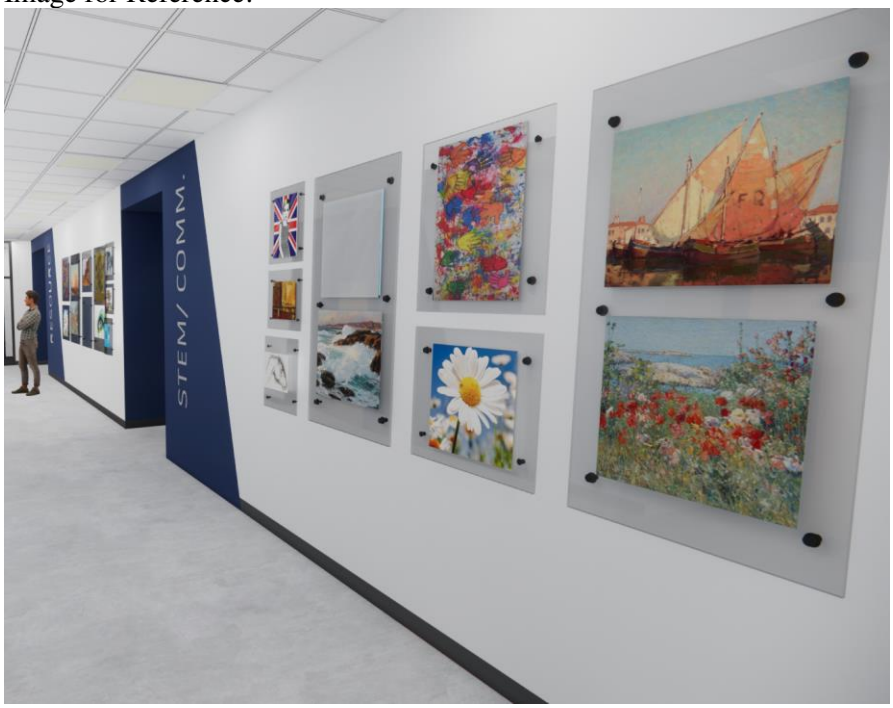
2. Character Material: Acrylic

3. Character Height: As indicated on Drawings.
4. Thickness: 1” thick.

5. Finishes:

   a. Acrylic Finish: White

6. Mounting: Combination All Mount
7. Typeface: To be selected.
8. Image for Reference:



2.2 Exterior Dimensional Fabricated Channel Characters: Metal face with metal side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.

1. Manufacturers:

   a. A.C.E. Sign Systems.
   b. Allen Industries Signage & Architectural Elements.
   c. ASI Sign Systems, Inc.
   d. Best Sign Systems, Inc.
   e. Charleston Manufacturing, LLC.
   f. Gemini Inc.
   g. Signs & Decal Corp.

2. Illuminated Characters: Backlighted character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed

joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.

a. Power: 120 V, 60 Hz, 1 phase, 15 A.
b. Weeps: Provide weep holes to drain water at lowest part of exterior characters. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.

3. Character Material: Sheet or plate aluminum.

a. District Logo:
   1) Dark Blue HEX #3053A4
   2) Bright Blue HEX #0096D6
   3) Yellow HEX #FDB521
   4) Black
b. School Name (Willow School) – color as selected by Architect from manufacturer's full range.

4. Material Thickness: Manufacturer's standard for size and design of character.
5. Character Height: As indicated on Drawings.
6. Character Depth: 3 inches, unless otherwise indicated.
7. Typeface: Avenir
8. Mounting: Concealed studs.

a. Hold characters at 1 inch distance from wall surface.

9. Font Typeface: Custom logos as indicated. Contact the Architect for additional details.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Bottom Rail Mount: Rails to be flush with ends of first and last letter.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Bottom Rail: Backs of letters are drilled and tapped to receive screws to secure letters onto one horizontal metal rail.

END OF SECTION 101419

SECTION 101423
PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior panel signs

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Plaque: Show detailed layout to scale with accurate font, letter sizes, finish, exact text for approval by owner and architect.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Acrylic.

D. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

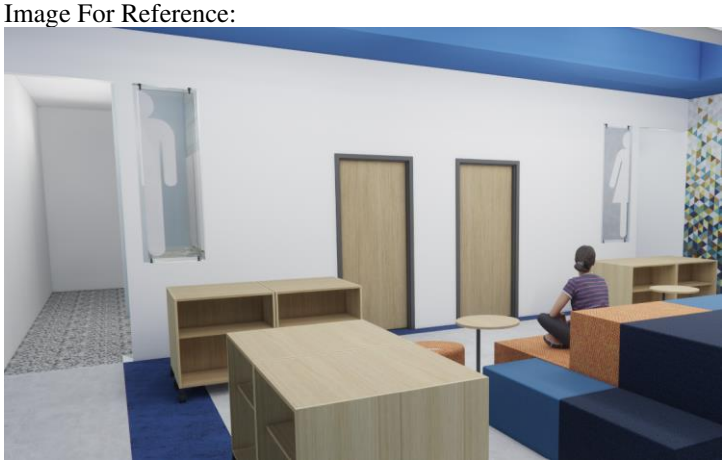
2.2 PANEL INFOGRAPHIC SIGNAGE

A. Manufacturers: Basis of Design:

1. 3Form
   a. Contact: Allyson Hemsworth
   b. Phone: 248-895-6522
   c. Email: Allyson.hemsworth@3-form.com

2. Panel Signage – Building Systems Infographic
   a. Eco Resin: Digital Print
   b. Material: Varia or equal
   c. Pattern: Solid
      Graphics: To be provided to signage company.
   d. Mounting Hardware: Point support hardware.
      1) Manufacturer recommended installation.
      2) Varia Stand-Off Wall Mounts
   e. Image for Reference:

3. Panel Signage – Bathroom Pictorial Sign
   a. Eco Resin: Digital Print
   b. Material: Varia or equal
   c. Pattern: Vellum front and back
   d. Size: See Sheet A1.10 for sizes.
   e. Graphic:
      1) (1) Female Pictorial per restroom group - WHITE (As shown Below)
      2) (1) Male Pictorial per restroom group – WHITE (As shown Below)
   f. Mounting Hardware: Point support hardware.
      1) Manufacturer recommended installation.
      2) Glass Clamp Hardware: Brush Nickle Finish
4. Image For Reference:



2.4 FABRICATION

B. General: Provide manufacturer's standard signs of configurations indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
2. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.3 FINISHES, GENERAL

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
3. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101423-3

SECTION 101423.16
ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached.

B. Vinyl Graphics

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements , including raised characters and Braille, and layout for each sign at least .

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample .

2. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Deterioration of embedded graphic image.
   c. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1 .

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. APCO Graphics, Inc.; Equal
   b. ASI Sign Systems, Inc.; InTac Series
   c. Inpro Corporation; Equal
   d. Takeform; Fusion
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign .

b. Surface-Applied Graphics: Applied vinyl film .
c. Color(s): As indicated on drawings.

3. Sign-Panel Perimeter: Finish edges smooth.
   a. Edge Condition : Square cut .
   b. Corner Condition in Elevation: Square .
4. Mounting: Surface mounted to wall with concealed fasteners
5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as scheduled . Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 VINYL GRAPHICS

A. Vinyl: Precision Cut, high quality vinyl, 3mil thick (min.)

B. Install per manufacturer’s written instructions for GYP wall installations.

C. Size and font: As indicated on drawings

D. Color: White

2.4 SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. A. Provide back plate for signs to be mounted on glass

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner .

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls and according to the accessibility standard .

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

D. For all glass mounted signage, provide matching back plate on opposite side to conceal mounting method.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.3 SCHEDULE

A. Signage details on Sheet A1.10

B. Provide new room signage for all spaces and every entry point to spaces

C. Provide one evacuation map for every classroom and lab.

END OF SECTION 101423.16

SECTION 102113.17
PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge with associated fasteners.
2. Latch and Keeper: Two latches and keepers with associated fasteners.
3. Door Bumper: One door bumper with associated fasteners.
4. Door Pull: One door pull with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

A. Manufacturers subject to compliance:

1. ASI Global Partitions – Ultimate Privacy
2. Bradley
3. Bobrick

4. General Partition
5. Metpar
6. Architect’s approved equal.

B. Toilet-Enclosure Style: Floor anchored.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

E. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

G. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Architect from manufacturer’s full range.
   a. To be selected from manufacturer’s full range.
3. Edge Color: with manufacturer's standard dark color core.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless-steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

B. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Floor Anchored Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

   a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102123
CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Curtain tracks and carriers.
2. Cubicle and curtains with 6, 6 snap.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include durability, laundry temperature limits, fade resistance, applied curtain treatment, and fire-test-response characteristics for each type of curtain fabric indicated.
2. Include data for each type of track.

B. Shop Drawings:

1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details on blocking above ceiling.

C. Samples: For each exposed product and for each color and texture specified, 10 inches in size.

D. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:

1. Curtain Fabric: 10-inch-square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Curtain Carriers and Track End Caps: Full-size units equal to 1 percent of amount installed but no fewer than 10 units.
2. Curtains: One full size unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:

1. Launderable to a temperature of not less than 160 deg F.
2. Flame resistant and identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CURTAIN SUPPORT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. InPro Corporation (IPC)
2. Construction Specialties, Inc
3. S.O.S.
4. Cubicle Curtain Factory, Inc.
5. Architect’s pre-approved equal.

B. Extruded-Aluminum Curtain Track: Not less than 5/8 inch wide by 1/2 inch high; with manufacturer's standard wall thickness.

1. Curved Track: Factory-fabricated, 12-inch-radius bends.
2. Finish: Clear anodized.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. End Stop: Removable with carrier hook.
2. Switch Unit: Shuttle and coupling device for rerouting and securing cubicle curtain, with pull chain for switching track.

D. Curtain Carriers: Two nylon rollers and nylon axle with aluminum hook.

E. Curtain Carriers: One-piece nylon glide with chrome-plated steel hook.

F. Breakaway Curtain Carriers: 6, 6 snap- configuration breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf.

G. Exposed Fasteners: Stainless steel.

H. Concealed Fasteners: Hot-dip galvanized.

2.3 CURTAINS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. InPro Corporation (IPC)
2. Construction Specialties, Inc
3. S.O.S.
4. Cubicle Curtain Factory, Inc.
5. Architect’s Pre-approved equal

B. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent polyester; inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Products: Subject to compliance with requirements, provide the following:

   a. Architex Fabric

2. Pattern: RX1008
3. Color: Tranquil
4. Width: 72 inches.
5. Image for reference:

C. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

D. Mesh Top: Not less than 20-inch- high mesh top of No. 40 nylon mesh.

1. Color: White.
2. Provide snap line at base mesh per manufacturer's standards.

E. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

F. Curtain to start 12" a.f.f., verify length in field.

2.4 CURTAIN FABRICATION

A. Fabricate curtains as follows:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor as follows:

   a. Cubicle Curtains: 8 inches.

3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Mesh Top: Top hem of mesh not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.

   a. Snap seal line at manufacturers standard spacing.

5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lock stitched at 18.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 20 feet in length, provide track fabricated from single, continuous length.

1. Curtain Track Mounting: Surface.

C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:

1. Mechanically fasten to suspended ceiling grid with screws.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

1. Wall tie back. Coordinate location with Owner’s Representative.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 102123

SECTION 102600
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 09 Section "Interior Painting". Coordinate wall prep with paint contractor.

1.2 SUMMARY

A. Section Includes:
   1. Aluminum Corner guards.
   2. Aluminum End-wall guards.
   3. FRP wall coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
   2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

   1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Abuse-Resistant Wall Covering: 6 by 6 inches square.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1

2.3 CORNER GUARDS

A. Surface-Mounted, Aluminum Corner Guards: Manufacturer's standard, assembly consisting of aluminum; including mounting hardware; fabricated with 90- match wall condition.

1. Manufacturer: Select from the following:
   a. InPro Corp; Aluminum Corner Guards
   b. CS Acrovyn; Eqaual
   c. Koroguard; Equal
   d. The Corner Guard Store

2. Color and Texture: Clear anodized finish

   a. Profile: 1-1/2” (38 mm)
   b. Height: 8’-0”

3. Attachment - #535 Heavy Duty Adhesive
4. Materials: Aluminum: Aluminum Corner Guards shall be manufactured from 5005-H34 or 6063-T6 alum.
5. Attachment-Adhesive: Field applied heavy-duty adhesive.

2.4 END-WALL GUARDS

A. Surface-Mounted, aluminum, End-Wall Guard. Manufacturer's standard assembly consisting of aluminum; including mounting hardware.

1. Manufacturer: Select from the following:
   a. InPro Corp; Aluminum Corner Guards
   b. CS Acrovyn; Eqaual
   c. Koroguard; Equal
   d. The Corner Guard Store

2. Color and Texture: Clear anodized finish

   a. Profile: 1-1/2” (38 mm)
   b. Height: 8’-0”

3. Attachment - #535 Heavy Duty Adhesive
4. Materials: Aluminum: Aluminum Corner Guards shall be manufactured from 5005-H34 or 6063-T6 alum.
5. Attachment-Adhesive: Field applied heavy-duty adhesive.

2.5 ABUSE-RESISTANT WALL COVERINGS

A. Abuse-Resistant Sheet Wall Covering (**FRP-1 @ Kitchen**): Fabricated from semirigid, plastic sheet wall-covering material.

1. Manufacturers: Provide one of the following:
   a. InPro Corp
   b. Koroguard
   c. Pawling Corp
   d. Marlite; Standard FRP Panels
2. Size: 4’-0” x 10’-0” sheet
3. Sheet Thickness: 3/32 inch
4. Color and Texture: As selected by Architect from manufacturer's full range
5. Height: Full Wall
6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
7. Mounting: Adhesive per manufacturer’s written instructions

2.6 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

2.7 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end and top caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Diaper Changing Stations
3. Mop and Broom Rack

B. Owner-Furnished Material: See accessory list for owner supplied items.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to be included in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

B. Toilet Paper (Roll) Dispenser: **TA-1**

1. Provided by Owner and installed by Contractor.

C. Liquid-Soap Dispenser: **TA-2**

1. Provided by Owner and installed by Contractor.

D. Semi-recessed Paper Towel Dispenser/Waste Receptacle Combo Unit – 18 GAL: **TA-3A**

1) Basis-of-Design Product: Bradley Corp. #2271-10
2) Mounting: Semi-Recessed.
3) Door or Cover: Self-closing, disposal-opening cover.
4) Receptacle: Removable.
5) Material and Finish: Stainless steel, No. 4 finish (satin).

E. Recessed Paper Towel Dispenser/Waste Receptacle Combo Unit – 4.9 GAL: **TA-3B**

1) Basis-of-Design Product: Bradley Corp. #235.11
2) Mounting: Recessed.
3) Door or Cover: Self-closing, disposal-opening cover.
4) Receptacle: Removable.
5) Material and Finish: Stainless steel, No. 4 finish (satin).

F. Semi-recessed Paper Towel Dispenser/Waste Receptacle Combo Unit – 12 GAL: **TA-3A**

1) Basis-of-Design Product: Bradley Corp. #237-10
2) Mounting: Semi-Recessed.
3) Door or Cover: Self-closing, disposal-opening cover.
4) Receptacle: Removable.
5) Material and Finish: Stainless steel, No. 4 finish (satin).

G. Sanitary-Napkin Disposal Unit: **TA-4**

1) Basis-of-Design Product: Bobrick #B-254.
2) Mounting: Surface mounted.
3) Door or Cover: Self-closing, disposal-opening cover.
4) Receptacle: Removable.
5) Material and Finish: Stainless steel, No. 4 finish (satin).

H. Grab Bar: **TA-5**

1. Basis-of-Design Product: Bradley Corp. 812 x 42”
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

   a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.

G. Grab Bar: **TA-6**

1. Basis-of-Design Product: Bradley Corp. #812 x 36”
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.

H. Grab Bar: **TA-7**

1. Basis-of-Design Product: Bradley Corp. #812 x 18.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: 18”
6. Mounting: Mount vertical on side wall above grab bar. Center 40” from back wall and set bottom of bar at 40” above floor.

I. Grab Bar: **TA-8**

1. Basis-of-Design Product: Bobrick #B-68616
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: L-shaped 24”x36”

J. Mirror Unit: **TA-9**

1. Basis-of-Design Product: Bobrick #B-165
2. Frame: Stainless-steel channel.

    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: Refer to toilet accessory schedule.

2.2 CHILDCARE ACCESSORIES

A. Baby Changing Station: **TA-13**

1. Basis-of-Design Product: Bradley #9611.
2. Mounting: Surface mounted.
3. Material: High density polyethylene. Hinge shall have full length steel hinge pine and concealed gas shock.
4. Features: Unit to include integrated paper liner dispenser, integral bag hook and safety strap with unbreakable buckle.

2.3 OTHER ACCESSORIES

A. Shower Curtain/Rod/Hooks: **TA-10**

1. Curtain Basis-of-Design Product: Bradley #9537. 36" @ Shower; 60" @ Tub.
   a. Material: 10 ounce nylon reinforced anti-bacterial vinyl fabric; flameproof; stain resistant; self-deodorizing; furnish with aluminum grommets on 6" center; all sides hemmed; color to be white.

2. Rod Basis-of-Design Product: Bradley #9539. 36" @ Shower; 60" @ Tub.

   a. Mounting: Concealed mounting. Mounting flanges shall be glass polypropylene with snap-on vandal-resistant protective escutcheons.

   b. Material: Tubing to be 18 gauge stainless steel, architectural satin finish.

3. Hooks Basis-of-Design Product: Bradley #9536.

   a. Material: Stainless steel spring wire with snap fastener.
4.

B. Mop and Broom Rack: **TA-11**

1. Basis-of-Design Product: Bobrick B-223x36.
2. Size: 36 inches wide, 5 inches high
3. Description: Anti-Slip mop holders with spring-loaded rubber cam that grips handles 7/8 to 1-1/4 inch diameter. Holds mops 3-1/4 inch from wall. Holds four mops/brooms.
4. Mounting: Flanges with concealed fasteners.
5. Material: Stainless steel.
   a. Finish: Smooth, satin finish.

C. Wardrobe Hooks: **TA-12**

1. Basis-of-Design Product: Bobrick B-233.
2. Mounting: Flange with concealed mounting.
3. Material: Stainless Steel.
   Finish: Architectural satin finish.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire protection cabinets and portable, hand-carried fire extinguishers, and mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. Material Compliance Certificate: Submit completed Material Compliance Certificate as described in Specification Section 013300 – Architect's Submittal Procedures.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

B. Coordinate recess sizes and locations of fire protection cabinets with wall depths. Notify Architect if cabinet projection from wall surfaces exceeds ADA limits.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For fire protection cabinets, include the following:
      a. Cabinet type, mounting, door and trim style; material and finish; glazing material; door hardware and accessories.
      b. Dimensions of individual components and profiles and rough-in dimensions.
      c. Details showing mounting methods, relationships of box and trim to surrounding construction, and construction details.
   2. For fire extinguishers, include the following:
      a. UL-rating and classification.
      b. Dimensions of individual components and profiles.
      c. Material and finish.
      d. Wall mounting brackets.

B. Shop Drawings: Indicate types and locations of cabinets and fire extinguishers including mounting heights.

C. Product Schedule: For fire protection cabinets and fire extinguishers. Use same designations indicated on Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:

      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.

   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   2. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   3. Larsen's Manufacturing Company.

B. Source Limitations: Obtain each type of fire protection specialty through one source from a single manufacturer for entire Project.

2.2 DESCRIPTION

A. Regulatory Requirements:

1. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.
2. Fire-Resistance-Rated Cabinets: Listed and labeled per ASTM E814 for fire-resistance rating of walls where installed.
3. Fire Extinguishers: Comply with NFPA 10 and applicable codes.
   a. Provide fire extinguishers listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction for purpose specified and as indicated.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated with manufacturer's standard valves, handles, and levers.
   1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A: 60-B-C, 10-lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.4 FIRE EXTINGUISHER CABINETS

A. Mounting:

1. Provide recessed units where wall cavities are of sufficient depth to accommodate required cabinet depth.
2. Provide semi-recessed units where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet depth.

B. Recessed Cabinet Type: Cabinet box, suitable for fire extinguisher, fully recessed in walls.

1. Framed Door Style: Fully glazed.
2. Cabinet Trim Style: Exposed square trim.
   a. Exposed Square Trim: Flange of same metal and finish as box overlaps surrounding wall finish and is covered by exposed, square-edge trim of same metal and finish as door with 1/4 to 1/2 inch wall return at outer edge (backbend).
3. Door and Trim Material: Stainless steel.
4. Glazing: Acrylic.
5. Hardware: Recessed pull, roller catch, and standard hinge.

C. Semi-Recessed Cabinet Type: Cabinet box, suitable for fire extinguisher, partially recessed in walls; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Framed Door Style: Fully glazed.
2. Cabinet Trim Style: Rolled-edge trim.

a. Rolled-Edge Trim: Minimum projection required to suit wall depth but not more than 4 inch maximum backbend depth.

3. Door and Trim Material: Stainless steel.
4. Glazing: Acrylic.
5. Hardware: Recessed pull, roller catch, and standard hinge.

2.5 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Badger Fire Protection; a Kidde company.
b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
c. Larsen's Manufacturing Company.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A666, Type 304.

C. Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

1. Color: Transparent clear.
2. Form: Flat sheet.

D. Hardware: Provide proper type for cabinet type, trim style, and door material and style indicated.

1. Pull: Provide manufacturer's standard recessed pull.
   a. Finish: Brushed Chrome.
2. Latch: Provide manufacturer's standard friction or roller latch.
3. Hinge: Provide manufacturer's standard hinge permitting door to open 180 degrees.

2.7 FABRICATION

A. Fire Extinguisher Cabinets: Provide manufacturer's standard box (tub) to suit cabinet type, door and trim style indicated.

1. Construction: Provide non-fire-rated cabinets in non-fire-rated walls. Provide fire-rated cabinets in fire-rated walls with fire-rating equal to or greater than wall fire-rating and tested per ANSI/UL-1479 and/ or ASTM E814 for membrane penetration firestops.
2. Weld joints and grind smooth.
3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors per manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate glazed door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick. Miter and weld frame perimeter.
2. Prepare doors and frames to receive hardware.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

2. Fasten cabinets to structure, square and plumb.

3. Seal penetrations with firestopping sealant at Fire-Rated Cabinets.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113
METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. All welded metal, corridor lockers.
2. All welded, athletic metal lockers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
   a. Locks.
   b. Blank identification plates.
   c. Hooks.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate sizes and locations of wood bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Faulty operation of latches and other door hardware.
2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

1.12 PRODUCTS - MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

1.13 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in the ADA standards of the Federal agency having jurisdiction and ICC A117.1 .

B. Basis-of-Design Product: Subject to compliance with requirements, Republic - Metal Storage Lockers or comparable product by the following.
1. DeBourgh Mfg. Co.; Worley Lockers.
2. List Industries Inc.; Lockers.
3. Lyon Workspace Products, LLC; Lockers.
4. Penco Products, Inc.
5. Republic Storage Systems Company; Lockers.

C. Material: Cold-rolled steel sheet.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inchnominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inchnominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024-inchnominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inchnominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2. Frame Vents: Fabricate face frames with vents.

F. Doors: One piece; fabricated from 0.060-inchnominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches wide may be fabricated from 0.048-inchnominal-thickness steel sheet.
2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inchnominal-thickness steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inchnominal-thickness steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.

6. Door Style: Vented panel as follows:

a. Concealed Vents: Slotted perforations top and bottom horizontal return flanges of doors.

G. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1) Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
2) Backs and Sides: 0.024-inchnominal thickness, with full-height, double-flanged connections.
3) Shelves: 0.024-inchominal thickness, with double bend at front and single bend at sides and back.

H. Frames: Channel formed; fabricated from 0.060-inchnominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1) Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2) Frame Vents: Fabricate face frames with vents.

I. Hinges: Welded to door and attached to door frame with rivets that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Continuous Hinges: Manufacturer's standard, steel continuous hinge.

J. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inchesand higher with three latch hooks and doors less than 48 incheshigh with two latch hooks; fabricated from 0.105-inchnominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

K. Locks: Built-in combination locks.

L. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

2. Filler Panels: Fabricated from 0.048-inchnominal-thickness steel sheet.
3. Boxed End Panels: Fabricated from 0.060-inchnominal-thickness steel sheet.
4. Finished End Panels: Fabricated from 0.024-inchnominal-thickness steel sheet.
5. Center Dividers: Fabricated from 0.024-inchnominal-thickness steel sheet.
6. Steel Zee Base: Fabricated from 16 gauge steel 4" high.

M. Finish: Baked enamel or powder coat.

N. Locker Schedule:

1. **MLW-#**: Single Stack Locker 12" x 15"D x 72"
a. **MLW-1**: Republic - quiet corridor lockers/ single tier: custom-blue (corridor – unit 300)

b. **MLW-2**: Republic- quiet corridor lockers/ single tier: custom-purple (corridor – unit 400)

2. **MLW-3**: Republic-PDQ 3 wide/ Dbl Stack Locker 12” x 15”D x 72”

~~b.~~a.

~~2.~~3. **MAL-#**: Single Stack Locker 12” x 15”D x 60”

a. **MAL-1**: Republic – Heavy Duty Ventilated lockers/ double tier sloped top: Midnight Blue (corridor – unit 300)

b. Accessories:

1) Continuous Sloping Tops: Fabricated from 0.048-inchnominal-thickness steel sheet.

2) Closures: Vertical-end type.

c. Sloping-top corner fillers, mitered.

1.14 LOCKS

A. Built-in combination locks.

1.15 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

G. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

I. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

J. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

1.16 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers .
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

2.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Adjust built-in locks to prevent binding of dial or key and ensure smooth operation prior to substantial completion.

C. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

2.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 113013
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooking appliances.

2. Refrigeration appliances.

3. Cleaning appliances.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COOKING APPLIANCES

A. Microwave Oven:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amana; Whirlpool Corporation.

b. Bosch US; BSH Home Appliances Corporation.

c. Fisher & Paykel Appliances Ltd.

d. Frigidaire.

e. GE Appliances; Haier Group.

f. Kenmore; Transformco SR Brands LLC.

g. KitchenAid; Whirlpool Corporation.

h. LG Electronics USA, Inc.; LG Electronics Inc.

i. Sharp Electronics Corp.

j. Whirlpool Corporation.

2. Microwave Power Rating: Manufacturer's standard.

3. Material: Stainless steel.

2.3 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amana; Whirlpool Corporation.

b. Bosch US; BSH Home Appliances Corporation.

c. Fisher & Paykel Appliances Ltd.

d. Frigidaire.

e. GE Appliances; Haier Group.

f. Kenmore; Transformco SR Brands LLC.

g. KitchenAid; Whirlpool Corporation.

h. LG Electronics USA, Inc.; LG Electronics Inc.

i. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC).

j. Whirlpool Corporation.

2. Type: Freestanding Built in Undercounter.

3. Storage Capacity:

a. Refrigeration Compartment Volume: 15.6 cu. ft.

b. Freezer Volume: 5.13 cu. ft.

4. General Features:

a. Interior light in refrigeration compartment.

b. Automatic defrost.

c. Interior light in freezer compartment.

d. Automatic icemaker and storage bin.

5. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.

6. Front Panel(s): Stainless steel.

2.4 CLEANING APPLIANCES

1. Type: Built-in undercounter.

a. Counter is 34 inches AFF to surface

2. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.

3. Front Panel: Stainless steel.

B. Clothes Washer: Complying with AHAM HLW-1.

1. Manufacturers: Subject to compliance with requirements, provide products by

one of the following:

a. Amana; Whirlpool Corporation.

b. Bosch US; BSH Home Appliances Corporation.

c. Fisher & Paykel Appliances Ltd.

d. Frigidaire.

e. GE Appliances; Haier Group.

f. Kenmore; Transformco SR Brands LLC.

g. Maytag; Whirlpool Corporation.

h. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC).

i. Whirlpool Corporation.

2. Type: Freestanding, top-loading unit.

3. Capacity: 3.8 cu. ft.

4. Agitator: Center spindle.

5. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.

6. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.

7. Appliance Finish: Enamel.

C. Clothes Dryer: Complying with AHAM HLD-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amana; Whirlpool Corporation.

b. Bosch US; BSH Home Appliances Corporation.

c. Fisher & Paykel Appliances Ltd.

d. GE Appliances; Haier Group.

e. Kenmore; Transformco SR Brands LLC.

f. LG Electronics USA, Inc.; LG Electronics Inc.

g. Maytag; Whirlpool Corporation.

h. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC).

i. Whirlpool Corporation.

2. Type: Freestanding, frontloading, electric unit.

3. Capacity: 5.7 cu. ft.

4. Features:

a. Interior drum light.

5. Appliance Finish: Enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

EQUIPMENT SCHEDULE

RF-1	REFRIGERATOR/FREEZER	TEACHER LOUNGE	30X32
		FAMILY RM	30X32
		SUPPORT OFFICE	30X32
URF-1	= UNDERCOUNTER REF.	NURSE STATION	24x24x33.75
WSHR	= WASHER	FAMILY RM	27x32
DRY	= ELEC. DRYER	FAMILY RM	27X32
MC-1	= MICROWAVE	FAMILY RM	TO FIT 28WX 18DX16 H CABINET
MC-2	= MICROWAVE	TEACHER'S LOUNGE	TO FIT 28WX 18DX16 H CABINET

END OF SECTION 113013

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

Articles 1 through 14 - Standard Form of General Conditions

The entire work shall be subject to the requirements of General Conditions of the Contract for Construction, AIA Documents and specifications, as issued by the Architect, except that any provisions which may be in conflict or are inconsistent with any of the articles of the following Supplementary Conditions shall be void to the extent of such conflict or inconsistency. Contractors will be held to have examined and become fully acquainted with all provisions of this document.

All references to the "Standard Form of General Conditions" as hereinafter used in these specifications shall refer to the above document. The Foodservice Equipment Contractor shall be a subcontractor of the Construction Manager unless otherwise directed by the Architect or contract documents.

1.1 SECTION INCLUDES

A. Foodservice Equipment: Includes standard manufactured and custom fabricated items.

B. Inclusive of Job: The work under this section consists of providing all labor, material, products and equipment that are necessary and required for the complete installation of the foodservice equipment, as indicated on drawings, as herein specified, and as required by all prevailing code requirements of Local, State and Federal entities.

1.2 RELATED SECTIONS

Architectural Documents: All work described in these documents must be carefully coordinated with the work of those other trades directed by the terms and conditions of the Design Teams documents. The drawings and specifications of the Architect and instructions of the Architect and the Construction Manager shall direct the Foodservice Equipment Contractor (F.E.C.) with respect to the project schedule, contract issues, coordination, assignment of responsibility, site conditions, and payment requirements. Prior to the bid due date, these documents can be obtained by contacting the Architect and are to be considered in full force with respect to the work of the F.E.C. Contract: All work by the F.E.C. shall be performed under the contract and payment terms and conditions as defined in the Project Contract Documents. The F.E.C. will be expected to execute a final contract agreement after notice of award of contract, prior to start of work, but no later than 15 calendar days after Notice to Proceed. Provide a copy of your signed contract to Architect.

1.3 COORDINATION WITH OTHER TRADES

Note: The mechanical, plumbing and electrical requirements outlined in these foodservice documents include sections that stipulate the use of certain electrical, mechanical or ventilation components. The F.E.C. shall closely coordinate the work under this contract with the Construction Manager (C.M.) and other contractors including, but not limited to Electrical, Mechanical and Plumbing Contractors.

A. Coordinated Responsibilities:

1. F.E.C. will work closely with the Mechanical Contractor (also referred to as “M.C.”), Plumbing Contractor (also referred to as “P.C.”) and Electrical Contractor (also referred to as “E.C.”) answering any foodservice related questions that arise in the performance of their work. The F.E.C. is to proactively provide installation and connection information and guidance to the C.M., M.C., E.C., P.C. and others as appropriate to each piece of foodservice equipment in the project with regard to the rough-in of utilities, floor preparation, placement and connection of the equipment, building access for delivery, utility loads and other requirements, as necessary to ensure equipment is protected, installed and performs as specified; and the Project Contract Document specifications and all prevailing code requirements are met. Unless otherwise noted on drawings, it is the responsibility of the F.E.C. to closely coordinate the needs of the project to make certain that ALL UTILITY ROUGH-INS ARE LOCATED INSIDE OF WALL CAVITIES, WHERE ROUGH-INS ARE LOCATED AT WALLS. IN ADDITION, MAKE CERTAIN THAT THE INSTALLING TRADES DO NOT RUN ELECTRICAL WIRING, GAS, WATER, OR DRAIN LINES HORIZONTALLY OR VERTICALLY ON EXTERIOR WALL SURFACES. IF THESE REQUIREMENTS ARE NOT MET, THE F.E.C. WILL BE LIABLE FOR THE COST OF RELOCATING UTILITIES THAT DO NOT MEET THIS REQUIREMENT.

2. F.E.C. to furnish loose for installation by others: equipment specific gas hoses, pressure regulators, vacuum breakers, water filters, solenoid valves for water and steam, floor troughs and drain tempering kits, as required by code, the needs of each equipment item, or as required in the contract documents. Drain assemblies (up to the tailpipe or manifold unless otherwise indicated), faucets, waste valves, overflows and swirl sprays shall be installed by the F.E.C. Other non-F.E.C. entities will connect this hardware to the building systems.

3. F.E.C. shall coordinate location of grease traps with the P.C. or M.C. who will be responsible for providing grease traps. Grease traps must be easily accessible for cleaning and maintenance. Grease trap location shall avoid any conflict with legs, braces, cross bracing supports, under-shelves, or other restrictions to access.

4. F.E.C. shall coordinate the location of any soda line chases with the installing trades. All chases must be located so that the soda chases are not visible to the customer. Where possible, the F.E.C. will coordinate the passage of these lines within the body of the foodservice equipment to minimize the need for field cutting and modification of these items. Under no circumstances will any part of the chase be exposed, or counters modified in field as a remedy for the failure to coordinate this work in a manner that would have minimized field installation challenges.

5. F.E.C. shall coordinate roll down shutter and pass-thru window requirements with the foodservice equipment. Anticipate that tracks or guides must be incorporated into backsplashes, counters, tables, equipment, et cetera so that the shutter

hardware appears to be integral with the foodservice equipment. Provide this information in a timely manner, to eliminate any need for rework.

6. The F.E.C. shall coordinate the location of all equipment near floor drains, floor sinks and floor troughs. Under no circumstance will it be acceptable to have equipment legs on top of floor drains, floor sinks or floor troughs. Coordinate these with the fabricators shop drawings.

7. If the F.E.C. is providing the hood canopies and/or the entire hood ventilation system, the F.E.C. is obligated to closely coordinate the ventilation work to ensure that system design and installation functions properly. The system must comply with all codes, completely capture particulates and smoke emitted from the equipment located beneath the hood and be carefully integrated into the building structure so that it does not interfere with structural, electrical, or mechanical devices.

8. The FEC will be required to identify on submittals installation in accordance with the SMACNA Guidelines for Seismic Restraint of Commercial Kitchen Equipment. It is the responsibility of the FEC to confirm such requirement with the authorities having jurisdiction. FEC to ensure applicable shop drawings are signed and sealed by the appropriate certifying engineer.

9. Mechanical, Plumbing and Electrical Contractors will disconnect and make safe any existing equipment prior to demolition and removal by the designated parties.

10. All foodservice equipment noted as existing, whether to be removed, relocated, cleaned, or reused shall be handled by the F.E.C.

11. If required, the approximate weight of any foodservice equipment is to be tabulated and reported to the Owner in a form appropriate for use in any project related documentation needs.

12. The F.E.C. will locate all controls for fabricated counters, whether power or water or waste, in a location that is secure, accessible and convenient for staff.

13. The F.E.C. will be responsible for purchasing and installing any fan units required to keep undercounter spaces below the manufacturer's recommended operating temperatures required for any undercounter equipment.

14. Where gas range equipment is provided, cap front manifolds, provide finishing panels and provide supply in rear of unit. F.E.C. to provide Dormont (or other approved) quick disconnect. Provide restraining cord. Restraining cord to be mounted to wall if blocking is provided. If blocking is not provided mount restraining cord to floor.

15. The F.E.C. will provide and pay for all permits, licenses and approvals that involve foodservice related refrigeration piping and any other categories of foodservice equipment work not included in the permits that will be provided and paid for by the Mechanical, Heating and Ventilation and/or Electrical Contractors.

B. The Plumbing Contractor, or Others as directed by the Contract Documents for the project, shall perform the following:

1. Make all final utility connections between the rough-in point and the equipment.

2. Provide all final connections to foodservice equipment including, but not limited to: faucets, sink drains, sink waste valves, overflow connections, disposer piping, troughveyors, hot food wells, floor troughs and other equipment associated with this project.

3. Provide traps, connecting pipe, shut-off valves, stops, floor drains, floor sinks, drain manifolds, vacuum breakers that are not specific to equipment, grease traps and all other hardware, supplies and parts necessary for the performance of work under this contract; unless specified otherwise in these Specifications. To minimize cleaning and corrosion problems, all exposed plumbing above any equipment or visible in any manner shall be stainless-steel or chrome plated. All exposed steam supply and return lines shall be insulated with a seamless, white, heat tolerant vinyl covers with access to valves.

4. Properly install all drain assemblies and shut off valves for sinks, and interconnecting piping between hot food wells, cold pans, troughveyor drain assemblies, and other equipment. All drain assemblies must be installed per all local health department prevailing codes and be commercial grade.

5. All work must meet all applicable state and local codes and site conditions.

C. The Electrical Contractor shall perform the following:

1. Make all final connections between the rough-in point and the equipment.

2. Provide all final connections to and between all foodservice equipment items including, but not limited to: disposers, cold pans, food wells, walk-ins, ventilation systems, serving counters, et cetera whether new, existing, or vendor supplied.

3. Furnish all safety cut-outs, line disconnect devices, shunt trip breakers, power panels, power cords, ground fault circuit interrupter receptacles, outlets, conduit, wire and other electrical controls, fittings and connections necessary for the installation of the foodservice equipment, with the exception of those specified or shown on drawings as a part of the foodservice equipment furnished by the F.E.C.

4. Work must meet all applicable state and local codes and conditions.

D. Other Contractors, as identified by the Project Contract Documents, shall perform the following:

1. Provide flues and/or vents of size and capacity required to properly ventilate the foodservice equipment except those system components that are being provided by the F.E.C.

2. Provide roof curbs, chases, floor openings, roof openings, flashing and sealing for foodservice ventilation.

3. Provide sleeves or chases of size and capacity required for refrigeration lines and wiring harnesses. Roof openings, flashing and sealing for foodservice refrigeration lines shall be provided.

1.4 DEFINITIONS AND ABBREVIATIONS

A. General Explanation: Certain terms and abbreviations used in Project Contract Documents are defined generally in this article. Definitions and explanations of this section are not necessarily either complete or exclusive but are general for the work to the extent not stated more explicitly in another provision of Project Contract Documents.

B. F.E.C.: Foodservice Equipment Contractor. The Foodservice Equipment Contractor is also referred to, variously, as the “F.S.E.C.” or the “Food Service Equipment Contractor or K.E.C. “Kitchen Equipment Contractor.”.

C. C.M.: Construction Manager. As read, work by the Construction Manager refers to work by the Construction Manager, as defined by the Project Contract Documents.

D. B.I.B.: Base Item Bid. The B.I.B is material, product, or equipment identified in the Item Specifications as the standard to be provided. In the Item Specifications for foodservice equipment, each item identifies a single manufacturer as the B.I.B. The B.I.B is to be distinguished from Contractor's Options, Mandatory Acceptable Manufacturers and Substitutions.

E. Mandatory Acceptable Manufacturer: The mandatory acceptable manufacturer must be quoted separately to fulfill the requirements of the bid. This cannot replace the Base Item Bid. A mandatory acceptable manufacturer should be, unless otherwise indicated, as close to the Base Item Bid in terms of performance, quality and construction. Acceptable manufacturers are governed by the terms and conditions of section 1.5.

F. Acceptable Manufacturer: An acceptable manufacturer is to be “as close as possible” to the standard set by the B.I.B. Acceptable manufacturers are considered manufacturers of lines that are similar enough to be interchangeable with the item specified. The F.E.C. must identify the manufacturer and model, which must be as close in all ways to the Base Item Bid with regard to performance, options, quality and construction.

G. Furnish: Except as otherwise defined in greater detail, term "furnish" shall mean supply and delivery of the equipment to the project site, as well as the unloading, unpacking, assembly, installation, calibration, and operator training of the same.

H. Install: Except as otherwise defined in greater detail, term "install" shall mean that the contractor shall perform all work as outlined in the Project Contract Documents; shall assemble and properly locate all equipment included in the contract and shall make all connections specified within the Project Contract Documents. Install shall also include whatever work is necessary to make the equipment ready for use, in full compliance with all code and project requirements.

I. Provide: Except as otherwise defined in greater detail, term "provide" shall mean and intend furnish, install, test, clean completely and make ready for intended use, as appropriate in each instance.

J. Indicated: The term "indicated" is a cross-reference to graphics, notes or schedules on drawings; to other paragraphs, or schedules in these specifications; and to similar means of recording requirements in Project Contract Documents. Use of terms such as "shown," "noted," "scheduled" and "specified" used in lieu of "indicated" is intended only to help reader locate cross-reference and no limitation of location is intended.

K. Directed, Requested, et cetera: Where not otherwise explained, terms such as "directed," "requested," "selected," "approved," "required," "accepted" and "permitted" mean "directed by Architect," "requested by Architect" and the like. However, no such implied meaning shall extend responsibility of Architect into the Contractor's area of supervision.

L. By Others: Reference to non-foodservice equipment contractor entities, to which work and/or responsibility will be assigned to by the C.M. F.E.C. responsible for coordination to ensure item(s) fit and are integrated as planned and that all utilities are provided.

M. Owner Furnished, Owner Installed (O.F.O.I.) – Items that the owner has purchased or possesses and will install or have another entity (outside of the construction contract) install. F.E.C. responsible for coordination to ensure item(s) fit and are integrated as planned and that all utilities are provided.

N. Project Site, Job Site: The space available to Contractor for performance of the Work, either exclusively or in conjunction with others performing other work as part of the Project.

O. Or: Used in inclusive sense to indicate alternatives of any item or any combination or items in a list unless otherwise indicated.

P. Include: The word “include” and its’ forms are not meant to limit provisions to a list nor to exclude other, unnamed items from a list which it precedes. The phrase, "but not limited to," may be assumed to follow uses of the words “include” and “including.”

Q. Installer: The entity (person or firm) engaged by the Owner, its’ C.M. or its subcontractor for performance of a particular unit of work at project site, including installation, erection, application, and similar required operations. It is a general requirement that such entities (Installers) be regionally recognized as expert in operations they are engaged to perform. The Installer or Installing Contractor is usually a mechanical, plumbing, or electrical contractor, although not limited to these categories.

R. RPZ: Reduced Pressure Zone Backflow Preventer

S. Cross Connection: A connection or arrangement of piping or appurtenances through which a backflow could occur. Cross connections may be made “directly” or “indirectly”.

T. Backflow: Water of questionable quality, wastes, or other contaminants entering a public water supply system due to a reversal of flow. Backflow can occur by either backpressure or back-siphonage conditions.

U. Backpressure: Backpressure conditions occur when the downstream pressure exceeds the upstream pressure.

V. Back-siphonage: Back-siphonage is caused by a vacuum or partial vacuum in a water supply system.

W. Composite wood and agrifiber products are defined as: particleboard, medium density fiberboard (MDF), plywood, wheatboard, and strawboard.

X. Chlorofluorocarbons - CFC - any of various gaseous compounds of carbon, hydrogen, chlorine, and fluorine, used as refrigerants and aerosol propellants, some of which break down the ozone in the atmosphere.

Y. Hydrochlorofluorocarbons - HCFC - a fluorocarbon that is replacing chlorofluorocarbon as a refrigerant and propellant in aerosol cans; considered to be somewhat less destructive to the atmosphere.

Z. Halon - Any of several compounds consisting of one or two carbon atoms combined with bromine and one or more other halogens. Halons are gases and are used as fire-extinguishing agents. They are between three and ten times more destructive to the ozone layer than CFCs are.

1.5 SPECIFIED MANUFACTURERS & MANDATORY ACCEPTABLE MANUFACTURERS

A. Specified Products & Materials: Certain, definite brands of materials, products and equipment are specified as the standard of quality for the Base Item Bid (B.I.B.) where one or more additional brands are named as B.I.B. manufacturers, the bid may be based on any one of the named brands.

B. Mandatory Acceptable Manufacturers: Acceptable manufacturers specified within this section are mandatory. If a manufacturer is simply named, then the F.E.C. may provide a quote from that manufacturer for an item that is as close as possible to the B.I.B. The F.E.C. cannot substitute the Mandatory Acceptable Manufacturer for the B.I.B. In other instances, the Mandatory Acceptable Manufacturer is to help understand the costs associated with additional options for the Item. Selection of a mandatory acceptable manufacturer is due to project conditions or other factors cause it to be in the Owner's interest to evaluate a different material, product or type of equipment.

1. Where an acceptable manufacturer is indicated in the bid documents as "Mandatory," or if it is not further qualified, the F.E.C. may provide a quote for the material, products and/or equipment identified in the Mandatory Acceptable Manufacturer. This is not a substitution for the B.I.B. and can be provided as a separate pricing for the school to determine if they want to substitute this item for the B.I.B. for the price savings.

2. Proposals for mandatory acceptable manufacturers shall include all costs necessary to include them into the project. Review each mandatory acceptable manufacturer to determine its effect on your project. F.E.C. to include in the proposal miscellaneous devices, appurtenances and other items incidental to or

required for a complete installation whether or not directly mentioned as part of the mandatory acceptable manufacturer.

3. The Owner reserves the right to accept or reject any mandatory acceptable manufacturers at the time of awarding the Contract. If, during the progress of the work, it should become desirable to reinstate any mandatory acceptable manufacturer not included in the Contract, the Owner reserves the right to reinstate the mandatory acceptable manufacturer at the price bid by the F.E.C. provided that such action is taken in sufficient time as not to delay the progress of the work or cause additional expense to the F.E.C.

C. Acceptable Manufacturers: Other acceptable manufacturers have been identified in the Item Specifications. It is not the intention to discriminate against other brands or manufacturers whose materials, products or equipment is equal or better to what has been specified. Rather, the naming of a specific brand is intended to establish a definitive standard.

1. Acceptable manufacturers shall be selected on the basis of performance, features and options that most closely match that of the B.I.B.

2. Acceptable manufacturers proposed for range equipment must match with adjacent equipment, if possible.

3. Proposals for acceptable manufacturers shall include all costs necessary to include them into the work. Review each acceptable manufacturer to determine its effect on the project. F.E.C. to include in the B.I.B. miscellaneous devices, appurtenances and other items incidental to or required for a complete installation whether or not directly mentioned as part of the acceptable manufacturer.

4. The owner reserves the right to accept or reject any acceptable manufacturer listed bid. Bids must be based on B.I.B. items as specified, not per mandatory or voluntary acceptable manufacturers.

1.6 SUBSTITUTIONS

A. Requests for substitutions will be considered BEFORE award of contract when extensive revisions to the project contract documents are not required and any changes are in keeping with general intent of project contract documents; when fully documented and properly submitted; when any conditions stated elsewhere in the bid documents are satisfied; and when one or more of the following conditions are satisfied, all as judged by design team.

B. Where the required product, material, or method cannot be provided within the project schedule, but not as a result of F.E.C.'s failure to pursue the work promptly or coordinate various activities properly.

C. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non-

compliances which are not possible to otherwise overcome except by making requested substitution, which F.E.C. thereby certifies to overcome such non-compatibility, non-coordination, non-warranty, non-insurability or other non-compliance as claimed.

D. Where substantial advantage is offered, in terms of cost, time, energy conservation or other valuable considerations, after deducting offsetting responsibilities others may be required to bear, including additional compensation to the design team for redesign and evaluation services, increased cost of other work by design team or separate contractors and similar considerations.

E. Request for a substitution constitutes representation that F.E.C. has investigated proposed substitution and determined that it meets or exceeds specified product in all respects unless deficiencies are conspicuously noted; will provide same warranty for substitution as for specified product; will coordinate installation and make other changes which may be needed for work to be complete in all respects and do so at the F.E.C.'s expense; and waives claims for additional costs which may subsequently become apparent. Where such modifications require work by others, such as but not limited to the Owner, to the C.M., to Other Trades, to the Architect or Engineer, or Bakergroup, the cost of said work will be billed (back-charged) against the F.E.C.'s contract. This includes any substitutions/changes to equipment loads, locations, connections that are not clearly marked up on shop drawings for review by the design team, including but not limited to Bakergroup, architects, engineers, Construction Managers/Construction Managers, etc.

F. In addition, specific to ventilation: It is expected that any chosen mandatory acceptable manufacturer proposed will formally acknowledge, as a part of the evaluation process for changing from B.I.B. manufacturer, that they will meet the hood configuration shown in the project bidding documents, within their ventilation system code listing and without the need to modify air volumes (unless lower), hood dimensions, filter types or other characteristics of the original design solution. Any facility or machinery modifications that become necessary after the award of the foodservice equipment contract, due for any reason to the use of the mandatory acceptable manufacturer's ventilation equipment, will remain a cost to the foodservice equipment contractor. This includes, but is not limited to, structural modifications, changes in fan or duct size, clearances, fire protection, access or cleaning and other elements.

G. Only one request for substitution will be considered for any single product. Substitution requests will only be reviewed and possibly accepted if submitted in approved time to include in addendums/bulletins for documentation before bids are due. If substitution is not accepted or request for substation not received in time, F.E.C. shall provide specified and/or illustrated product.

H. F.E.C.'s submittal of (and Design Team's review of) shop drawings, product data, or samples which relate to work not complying with requirements of Project Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

I. No substitutions will be permitted following the award of Contract except under emergency conditions such as the sudden and unexpected discontinuance of an item of equipment by

the manufacturer. Determination of what conditions warrant emergency substitutions shall be at Design Team's judgment.

J. Identification of product or equipment being replaced by substitution shall include, but not be limited to, related specification section and drawing numbers, product data, drawings and catalog sheets and shall be fully documented to show compliance with requirements for substitutions.

K. Because of the practice of certain foodservice equipment manufacturers of offering rebates, gifts, "spiffs," bonuses, premiums, and other benefits to foodservice equipment dealers as well as individual salespeople and because the eligibility for such benefits may have an influence on the decision by a F.E.C. to propose a substitution, the receipt of and the eligibility for such benefits must be explicitly described. For each proposed substitution, provide a statement fully answering the following questions:

1. Is your firm eligible for any benefit, including but not restricted to, rebate programs based on quantities purchased in a given period, reductions in future prices, discounts, cash rewards or credits, if the proposed substitution is accepted?

2. Is any individual in your firm eligible for a cash payment, gift, reward, "spiff," or any other form of benefit if the proposed substitution is accepted?

L. Be prepared to attest to accuracy and completeness of this disclosure if requested by design team. Said attestation shall be in the form of a written statement from an officer of the manufacturer attesting to the accuracy and completeness of the F.E.C.'s disclosure. Where the manufacturer is represented by another firm for marketing purposes (commonly referred to as a manufacturer's rep), an officer of the representing firm also shall provide a signed statement attesting to the accuracy and completeness of the F.E.C.'s disclosure. Refusal or inability to provide said statements when requested shall be considered a withdrawal of the proposed substitution.

M. The fact that an F.E.C. or individual related to the F.E.C. is eligible for benefits should the proposed substitution be accepted, does not provide sufficient cause for declining the proposed substitution. However, where there is a difference in judgment or opinion between the Owner or Design Team and the F.E.C. as to whether the proposed substitution is in fact an equal to the B.I.B, said benefits will be considered in the decision to either accept or reject the proposed substitution.

N. Any substitution may require changes in the other parts of the work. By acceptance of a proposed substitution, no representation is made that the nature or extent of such modifications have been determined except as specifically identified by the F.E.C. in their proposal. All changes to the project work compelled by any substitution, whether or not identified in the F.E.C.'s proposal or that subsequently becomes apparent, shall be completed at the expense of the F.E.C.

O. Should a substitution be accepted and should the substitute material, product or equipment prove to be defective or otherwise unsatisfactory for the service or application intended, as evaluated by the design team and within the guarantee period as defined in these specifications, the F.E.C. shall replace this material, product, or equipment at no cost to

the Owner, with that originally specified. All costs of uninstalling, crating, shipping, and restocking shall be the responsibility of the F.E.C.

P. If a substitution is accepted it is the F.E.C.'s responsibility to ensure the electrical, mechanical and plumbing requirements match with those provided at the project site.

Q. Inability to Meet Project Requirements without Modification: If the F.E.C.'s bid for products or equipment must be altered to meet the Project Contract Documents and the F.E.C. Bidder makes no mention that these alterations are required, it will be interpreted that their Bid includes the alterations required.

1.7 SUBMITTALS

A. Preliminary Equipment Schedule: An equipment schedule must be provided by the F.E.C. through the C.M. (or apparent low bid Construction Manager) within seven (7) days of the bid opening. This schedule must include the item number, description, and manufacturer for all new equipment to be provided. The schedule shall also indicate if the piece of equipment is "B.O.D.", or other manufacturer. Note that no substitutions of food service equipment will be allowed unless submitted ten (10) days in advance of the bid date and approved by addendum.

B. Coordination Meeting: A coordination meeting shall be held within fourteen (14) days of the award of the foodservice equipment contract to review the equipment schedule and other relevant issues for coordination of F.E.C. items.

C. Distribution: Submittals shall be in conformance to the requirements set forth herein and as defined by the Project Contract Documents. All submittals shall be to the parties designated by the Project Contract Documents and copied to Architect.

D. Review: The review of submittals is only for compliance to design intent. For all submittals: DESIGN TEAM SHALL NOT BE RESPONSIBLE FOR CHECKING NOR FOR ADDRESSING DEVIATIONS FROM THE PROJECT CONTRACT DOCUMENT REQUIREMENTS OR CHANGES FROM EARLIER SUBMISSIONS. ALL CHANGES FROM THE PROJECT CONTRACT DOCUMENTS AND/OR EARLIER CONTRACTOR SUBMITTALS SHALL BE CONSPICUOUSLY AND SPECIFICALLY NOTED. Where such changes are indicated on shop drawings, note the drawing changes conspicuously and clearly describe the changes in the transmittal that accompanies the drawing.

The number of copies to be submitted and the deadline for submittal shall be as determined by the C.M. If printed copies are required by the owner and is not determined by the C.M., the F.E.C. shall provide eight (8) printed copies. The F.E.C. will be responsible for distribution of drawings and material documents to parties designated by the C.M.

E. Format: Submit Electronic files. Provide hard copies if determined by C.M. All drawing files shall use AutoCAD™ 2007 DWG and AdobeTM PDF, or a more recent version of the same program, and shall be in a drawing format that is acceptable to the owner and the C.M. All cutsheets, submitted electronically, shall be in AdobeTM PDF format.

F. Product Data: Submit buy out brochures, each item shall have a cover sheet with the following information: item number, manufacturer, quantity, model numbers, service

connection requirements, performances, materials, furnished accessories, power and fuel requirements, water and drainage requirements and other similar information. Second sheet shall be a manufacturer's cutsheet showing technical data, installation recommendations, service connection requirements, performances, materials, model numbers, furnished accessories, power/fuel requirements, water/drainage requirements and other similar information.

Where equipment is fabricated, provide cover sheet with the following information: item number, manufacturer, quantity, the words "SEE MANUFACTURERS SHOP DRAWINGS", include service connection requirements, materials, furnished accessories, power/fuel requirements, water/drainage requirements and other similar information.

G. Shop Drawings of Fabricated Equipment: Submit dimensioned fabrication drawings for custom fabricated equipment including plans, elevations and sections, showing materials and gauges used. Cross sections and elevations shall be detailed to a scale of 1-1/2" = 1'-0". Show complete details and dimensions of each item of equipment. Drawings shall be based upon and follow the design drawings and these specifications, without reference to field measurements. For seismic locations provide details in drawings of s seismic bracing for equipment and note that equipment conforms to Seismic Restraint guidelines. If required, include with these submittals, Letters of Assurance and Certificate for Seismic Restraint compliance. These are to be supplied from the applicable engineer, and to state that the installation and design meet all local, provincial, and federal relevant codes.

H. Utility Drawings: Submit drawings indicating: item numbers, equipment schedule including item number, quantity, description of each item and specific points and types of final connection for all utility requirements for foodservice equipment. Utility connections shall be located both horizontally and vertically and indicate details of connection required on each item. Prepare these drawings at 1/4" = 1'-0" scale minimum and in a CAD or BIM format acceptable to Owner. Submit separate drawings for equipment lay-out, electrical, plumbing and ventilation. Utility drawings shall include the information required for all equipment including existing, new, future, vendor, and any other equipment from any other sources made a part of this project. Unless there is a compelling reason to depart from the utility loads or locations shown on the bid documents, the F.E.C. will indicate the same loads and locations. If there is a compelling reason to modify the utility load or locations shown on the bid documents, the F.E.C. will recommend a solution, subject to approval, and conspicuously cloud the change.

I. Setting Drawings and Templates: Submit setting drawing and templates for installation of anchoring devices and for any item where required in the specifications. Submit setting drawings and templates at full scale.

J. Verifying Field Conditions: It is the sole responsibility of the F.E.C. to monitor the progress of the project and to coordinate both timely and mandatory field measurements necessary to achieve the best outcome for the project.

1. The F.E.C. shall visit the site at the appropriate times (before critical closures occur) to ensure that (1) plumbing, electrical and HVAC rough-ins meet with all equipment requirements, the Project Contract Documents and submittals and (2) that the finished walls, door locations and other building elements will exactly

match with the dimensional requirements of the equipment for operation, service and codes.

2. It is the sole responsibility of the F.E.C. to advise the Owner, the C.M., the Design Team, in a timely manner and in writing, of any need to depart from the requirements of the project, as outlined in the Project Contract Documents and subsequent formal project decisions.

3. After field measurements have been taken by the F.E.C., the F.E.C. shall revise their mechanical, electrical, ventilation and fabrication drawings to accurately reflect project conditions. Provide an electronic copy of that file to Architect and the C.M. Print and provide hard copies of the revised drawings to the same if required by the C.M. or owner.

4. The F.E.C. is responsible for making certain that all trades are using the most current and accurate drawings, and that the trades are fully aware of any special field conditions (e.g. “must hold” and close tolerance dimensions) that are required for the proper installation of the foodservice equipment.

5. The F.E.C. will be responsible for any remedial plumbing, electrical or HVAC work that results from their failure to comply with the inspection, timely submittal of project documents, drawings, cutsheets, and coordination requirements of this Project.

K. Ordering and Delivery Report: The F.E.C. shall issue regular, monthly updates to the Project Team. These updates must indicate the status of the shop drawings, loose equipment orders, fabrication progress and site work scheduled. The intent of this clause is to make certain that all parties to the project receive a monthly update indicating the exact status of the foodservice equipment order, fabrication and delivery times, document submittals and site meeting and inspection needs. Refer to 3.3A for more detail.

L. Operator's Manuals: Unless otherwise instructed by the C.M. or Architect, provide electronic copy of manual for review before print. Provide amount of printed copies needed per C.M. and/or owner. If amount is not specified, print and submit eight sets of dimensioned plans, data sheets, manuals and instructions for properly operating the foodservice equipment. Instructions for operating the equipment, together with written guarantee and warranty for each piece of equipment shall be bound in a booklet and presented to the Owner.

1. Provide a list including: item number, quantity, description, manufacturer, and model number of each piece of equipment and service agency contact; complete with name and phone numbers.

2. Provide manuals and instructions for each piece of equipment ninety days prior to the date that the project gets turned over to the Owner.

3. Provide manufacturers written guarantee and warranty forms for each piece of equipment.

4. Submit one electronic copy, in Adobe™ PDF format, of the Operator’s Manual.

M. As-built Documents: The F.E.C. shall produce as-built drawings of each drawing that was supplied by the F.E.C., its fabricator and manufacturers. Submit each drawing in electronic format (AutoCAD™ 2016 or more recent version). As-built drawings shall conform to the format requirements of the Owner, Architect and C.M. At a minimum, the F.E.C. shall update the as-built drawings (in CAD) to reflect all addenda, bulletins, field conditions, modifications to fabricated units and changes in equipment provided (including acceptable manufacturers). The F.E.C. shall provide periodic electronic CAD updates as required over the course of the project. F.E.C. agrees to reimburse Architect, as a deduct from this contract, for any time and out-of-pocket costs related to the failure of the F.E.C. to comply with this requirement. As-built drawings shall be provided within 45 days of substantial completion.

N. Samples: Submit samples of materials and products where indicated.

1. Submit two (2) of each sample. Confirm number of samples required with Architect. Provide additional samples, if required.

2. Samples shall be of sufficient size and quantity to illustrate the functional characteristics of the product with integral related parts, and attachment devices; and to clearly express the full range of color, texture and pattern.

3. Do not use products in the work until required sample review and approvals are completed.

O. Final Distribution: F.E.C. shall be responsible for the ongoing distribution of the most current, up to date information to all team members. Information to include, but not be limited to, all shop drawings, utility drawings, buy-out books, and all other documentation. Project team members are defined in the Project Contract Documents.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer must be able to show that it has been regularly engaged in manufacturing of foodservice equipment of types, capacities and sizes required, and that its products have been in satisfactory use in similar service for not less than five years.

B. F.E.C.'s Qualifications: Only those firms who can meet the following qualifications will be considered for this work:

1. The F.E.C. shall have at least five years successful experience furnishing and installing foodservice equipment on projects similar in size and scope to that required for this project.

2. The F.E.C. shall be the recognized distributor for the items of equipment specified herein, if of other manufacture than their own.

3. F.E.C. shall have the financial resources to enable the F.E.C. to handle the work in a satisfactory manner and to deliver the required items of equipment so as not to delay the progress of the work.

4. The F.E.C. shall be fully capable of fulfilling the terms and conditions of the warranty provisions required by this contract.

5. The F.E.C. shall be capable of providing a labor and/or material bonds when and if required.

6. Upon demand, the F.E.C. being considered for possible negotiation shall submit to Architect evidence of their ability to fulfill these requirements.

C. Fabricator's Qualifications: Where specified units require custom fabrication, provide units fabricated by a shop with a minimum of five years of experience in similar work. Fabricate all custom equipment items at the same shop. Where units cannot be fully shop-fabricated; complete fabrication work at project site in conformance to specification.

D. Pre-Approved Fabricators: Listed below are the pre-approved fabricators. Other fabricators to be considered must be submitted to Architect or C.M. for approval, in writing, prior to the bid submittal date and before the last addendum. This is, for possible approval. F.E.C. may choose to offer another fabricator not listed below as a voluntary mandatory acceptable manufacturer and listed separately from the base item bid.

Carbone Metal Fabricator, Inc.	240 Marginal St. Chelsea, MA 02150	(617) 884-0237
Commercial Stainless, Inc.	955 Patterson Dr., Bloomsburg, PA 17815	(570) 387-8982
Conover Custom Fab, Inc.	2625 S. Pennsylvania St., Indianapolis, IN 46225	(317) 784-1904
Great Lakes Stainless	1305 Stepke Court, Traverse City, MI 49684	(231) 943-7648
Institutional Equip, Inc.	704 Veterans Parkway, Bolingbrook, IL 60440	(630) 771-0990
John Boos	3601 S. Banker St. Effinham, IL 62401	(888) 431-2667
Nationwide Fabrication	10923 Leroy Dr., Northglenn, CO 80233	(303) 853-0107
Servco	3189 Jamieson Avenue, St. Louis, MO 63139-2595	(314) 781-3189
Titan Stainless Inc.	404 Usher Street, Pageland, SC 28728	(704) 243-8717

1.9 REFERENCE STANDARDS

A. Sanitary Construction and NSF Standards: Comply with applicable National Sanitation Foundation (NSF) standards and recommended criteria. Provide each principal item of foodservice equipment with an NSF "Seal of Approval".

B. Seismic Restraints: Provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment," unless otherwise indicated.

C. UL Labels: Where available, provide UL labels on prime electrical components of foodservice equipment. Provide UL "recognized marking" on other items with electrical components, signifying listing by UL, where available.

D. ANSI Standards: Comply with applicable ANSI standards for electric powered and gas-burning appliances, for piping to compressed gas cylinders and for plumbing fittings including vacuum breakers and air gaps to prevent siphonage in water piping.

E. NFPA Codes: Install foodservice equipment in accordance with the most current and/or applicable National Fire Protection Codes (NFPA) Codes for Gas, Electrical and Commercial Cooking Equipment.

F. ASME Boiler Code: Construct steam generating and closed steam heated equipment to comply with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

G. Health Code: Install foodservice equipment in accordance with local health department and all applicable regulations.

H. Architectural Millwork: Casework construction shall be of custom grade in accord with the standards of the Architectural Woodworking Institute or better. Casework will be considered any construction or fabrication requiring the use of wood or laminate.

I. Overlapping and Conflicting Requirements: Where compliance with two or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement (whether most costly or not) is intended and will be enforced, unless specifically detailed language written into Project Contract Documents clearly indicates that a less stringent requirement may be fulfilled. Refer instances of uncertainty as to apparent conflicts of standards to Architect and/or C.M. before proceeding.

J. Minimum Quality or Quantity: In every instance, quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either conform exactly to that minimum or may exceed that minimum. The F.E.C. accepts that Architect will make the final determination of the minimum quality or quantity for the work to be performed or provided. Refer instances of uncertainty as to quality or quantity intended to Architect before proceeding.

K. LEED - Leadership in Energy and Environmental Design - Comply with applicable standards per architect.

1.10 STORAGE, DELIVERY AND HANDLING

A. Storage: F.E.C. shall provide a safe and secure area in which any foodservice equipment that is a part of this project can be stored. Provide adequate protection from damage to or loss of this equipment. Store foodservice equipment in original containers, where available. The F.E.C. shall insure the equipment against damage and loss.

Should the Owner provide a facility for the receiving and storage of foodservice equipment, the F.E.C. shall, nevertheless, retain full responsibility for maintaining the condition of the equipment, shall fully insure it and name the Owner as additionally insured, and shall hold the Owner harmless from any damages or loss that should occur while stored in the Owner's premises.

B. Delivery: All deliveries are to be coordinated with the C.M. through a contact person who will be designated at time of award. All deliveries must be made to the jobsite or a location designated by the C.M. Any delivery errors are the responsibility of the F.E.C. who will rectify the error at no additional cost to the Owner or the Owner’s agent, or representative.

All foodservice equipment requiring fabrication (casework, counters, tables, breath protectors, walk-in refrigeration, hoods, ventilation ductwork, fire protection, et cetera) shall be delivered to the project site one month in advance of the expected installation date and securely stored. The cost of equipment storage will be the responsibility of the F.E.C. Prior to shipping fabricated items, the F.E.C. shall digitally photograph each item to document the condition of the equipment. Copies of the photographs shall be forwarded to C.M. and/or Architect, who will casually review the photographs, alerting the F.E.C. to any obvious errors and defects.

Do not deliver foodservice equipment until project conditions permit prompt installation. If the Owner, Architect or C.M. determines that the site is not ready for the delivery of equipment, the F.E.C. will retain said equipment in the F.E.C.’s storage facilities until the site is ready for installation. Deliver foodservice equipment to the project site in factory-fabricated containers designed to protect equipment and finishes until final installation.

Any piece of equipment that proves impractical for delivery in one piece may be delivered in sections, but all working surfaces shall be fitted and field welded, with working surfaces ground and polished on premises, so that upon completion, each item of equipment will have true, smooth, and even surfaces. Butt jointing and filling with solder will not be permitted.

C. Handling: Handle foodservice equipment carefully to avoid damage to components, enclosures, and finishes. Do not remove coverings until required to clean, test, calibrate and demonstrate the unit. DO NOT INSTALL DAMAGED FOODSERVICE EQUIPMENT; replace and return damaged components to equipment manufacturer.

D. Scheduling and Timeliness: Delivery and storage of all equipment shall be done at such time when construction, finish and mechanical work have progressed to a point permitting such installation. The details of setting and installation shall be so arranged that work of other contractors shall progress without being unnecessarily interfered with or damaged. The F.E.C. will be responsible for alerting project team members to any emerging or

ongoing issues that could undermine the F.E.C.'s ability to complete their work on schedule and within budget.

E. Protection of Equipment: All equipment shall be received at the building or construction site fully insured. It will be the responsibility of the F.E.C. to protect the equipment until completely installed, connected, and approved by Architect or C.M., subsequent to the completion of the contract work.

1.11 PROJECT CONDITIONS

A. Verification: Check and verify the electrical, water, steam, and gas characteristics of the site, including available water, steam, and gas pressures. The F.E.C. shall verify that the site utilities will meet the needs of the new, existing equipment scheduled for re-use, and vendor supplied items.

B. F.E.C. will be responsible for coordinating the utility needs of the equipment with site conditions. Do not order equipment that cannot be supported by the site utility structure. F.E.C. shall provide pressure regulating valves where required for proper operation of equipment.

C. Existing Foodservice Equipment: Work to include: Remove and relocate the equipment indicated in these specifications or on the project drawings as "Existing" or "Relocated."

1. F.E.C. shall visit the site, working with the Owner to tag or mark all equipment scheduled to be re-used. This shall be done prior to the disconnecting of the equipment. The F.E.C. shall be held accountable for any missing equipment for failure to tag or mark the equipment. The F.E.C. shall note utility requirements; dimensions, model numbers, et cetera and photo document all items. All existing equipment shall be removed from the facility prior to construction or at a date specified by the Owner, C.M. or Architect.

2. Equipment scheduled for reuse shall be taken to the F.E.C.'s storage area, cleaned and stored until it can be transported to the project site and installed. During the time said equipment is in the F.E.C.'s possession, it shall be protected from loss and damage; covered by the F.E.C.'s insurance that, in turn, complies with the Owner's terms and conditions for insuring assets stored by others; and delivered to the project site in same operating state that existed at the original site.

3. Equipment shall be cleaned of all grease, dirt and debris. The expectation is that surfaces will be void of any residue.

4. Paint where specified.

5. The F.E.C. shall document the operating condition of each piece of equipment PRIOR to disconnecting it for relocation. Digitally photograph all equipment before it has been disconnected.

6. Repairs and modifications to the equipment are NOT a part of this contract, unless specified for the Item. The Owner, however, is interested in F.E.C. suggestions for repair, reconditioning and upgrades to existing equipment. Estimates for this

work may be quoted separately, after the equipment has been removed and cleaned, and repair or reconditioning needs identified.

7. Equipment not scheduled for reuse shall be removed to location(s) designated by the Owner or by others, not by the F.E.C. With the Owner's concurrence, the F.E.C. may submit an offer to purchase all or part of the remaining equipment; and/or a cost proposal for removing and disposing of scrap equipment.

8. Disconnects of utilities to existing equipment will not be a part of the F.E.C.'s work. That work will be the responsibility of the trades performing the electrical, mechanical and plumbing work for the balance of the project.

D. Protection of Work and Property: The F.E.C. will be held responsible for any damage to Owner's property caused by delivering, uncrating, or installing of the Foodservice Equipment. If any damage is caused by the F.E.C., their agents or subcontractors, the Owner's property shall be restored to its original condition at the expense of the F.E.C.

E. Use of Premises: The F.E.C. shall confine the storage of equipment, materials, tools and all other things related to the F.E.C. work to space allotted to the F.E.C. by the Owner.

1.12 BIDDING

A. The bids shall be submitted as a pdf accompanied by an excel® worksheet. The bids shall identify pricing for each item (and component parts/accessories) listed on the equipment schedule, including items identified as alternates. Items identified as mandatory acceptable manufacturers shall have pricing identified for the base item as well as for each of the mandatory acceptable manufacturers. The owner will then select among the mandatory acceptable manufacturers and the base item manufacturer which manufacturer to use prior to the award of the bid. If project is located in seismic activity area, bidders are to provide Letters of Assurance for the Fire Suppression System(s) and a Certificate for Seismic Restraint compliance.

B. For budget control purposes only, prior to the award of the foodservice contract bid, the owner may elect to remove any item from the equipment award package and defer the item to be purchased later in the project, or to a future time after the project is completed, or to remove the item completely from the project.

C. Bid format

Use the following format for bid submission; inserting the appropriate number of columns for each Mandatory Acceptable Manufacturer in order to provide model #, manufacturer, selling price, total, Energy Star, low water consumption, other/note.

Item #	Item Description	Model #	Base Item Bid Manufacturer	Quantity	Selling Price Each	Total Selling Price	Energy Star	Low Water Consumption	Other/notes	Other

										Acceptable Manufacturers
1										
2										

PART 2 - PRODUCTS

2.1. GENERAL STANDARDS OF QUALITY

Quality of Material: Unless otherwise specified or shown on drawings, all material shall be new, of best quality, perfect and without flaws. All labor shall be performed in a thorough workmanlike manner. Work to be performed by qualified, efficient and skilled employees of the trades involved.

2.2. MATERIALS

A. New Materials: All materials shall be new, of first grade, no seconds will be acceptable. For all materials, the fabricator shall exactly match the manufacturer's requirements for performance and design. This will include the need to provide the materials and labor necessary to provide appropriate insulation, setoffs, spacing from other materials, temperature considerations and any other manufacturer specified needs for the material used.

B. Gauge: Gauges herein specified shall refer to United States Standard Gauge for sheet metal and plate.

C. Stainless-steel: All stainless-steel shall be of the gauge specified (U.S. Standard) 18.8 composition which is generally known as Type 304 and shall have a Number 4 Finish (125-150 grit) as manufactured within the continental limits of the United States. Each piece of equipment shall be specified by gauge with either a general specification form or under the Item Specifications. All sheets shall have a genuine mill finish of not less than 150 grit on one side and not less than 80 grit on the back side. All stainless-steel sheets shall bear the manufacturer's trade mark, designation of type and heat number. All stainless-steel sheets shall have the following content:

Chromium - 18 percent minimum
Nickel - 8 percent minimum
Carbon - 0.2 percent maximum

Straight chrome iron or copper bearing straight chrome steel is not acceptable. All stainless-steel sheets shall be stretcher leveled. All sheets shall be free of buckles, warps and surface imperfections. A hard ground finish will not be acceptable.

D. Stainless-steel Sheets: Shall be of cold rolled stock.

E. Stainless-steel Pipe and Tubing: ASTM A554, Type 304 with No. 4 polished finish; shall be seamless or welded, of gauge specified, of true roundness. Seamless tubing shall be thoroughly and properly annealed, pickled and ground smooth. Welded tubing shall be thoroughly heat-treated and properly quenched to eliminate carbide precipitation. V-Clad shall not be permitted.

F. Galvanized Iron: Wherever specified, galvanized iron shall be of an approved grade of either low carbon steel, pure wrought iron, or copper bearing steel. All sheets are to be commercial quality, stretcher leveled, bonderized and re-rolled to insure a smooth surface.

G. Galvanized Sheet Steel: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment

H. Sheet Steel: ASTM A569 hot-rolled carbon steel

I. Aluminum: ASTM B209 sheet and plate, ASTM B221 extrusions, 0.40-mill clear anodized finish where exposed, unless otherwise indicated

J. White Metal: Shall be corrosion-resistant metal containing not less than 21 percent nickel. Make castings free from pit marks, runs, checks, burrs, and other imperfections; rough grind, polish and buff to bright luster.

K. Plastic Materials and Components: Provide plastic materials and components which conform to NSF 51.

L. High Pressure Decorative Laminate (HPDL): HPDL shall be selected by the Architect from manufacturer's standard palette of colors, unless otherwise indicated.

Laminating adhesives shall contain no urea-formaldehyde resins. The adhesive must be suitable for use in areas where temperature ranges cycles from hot to cold and where moisture may be present at all times.

M. Adhesives, General: For adhesives, sealants, paints and coatings used inside the weather barrier of the project, submit manufacturer’s product data or Safety Data Sheet (SDS) showing printed statements of VOC content in grams per liter (g/L) and VOC emissions in accordance with CDPH Standard Method V1.1-2010 identifying the exposure scenario and total VOC’s after 14 days in milligrams per cubic meter (mg/m³). Document volume (L) used of wet applied products.

(Product) must comply with the limits of VOC content and VOC emissions as indicated in Division 1 Sustainable Design Requirements.

N. Hardwood Work Surfaces: Laminated edge-grained hard maple (Acer saccharum), NHLA First Grade with knots, holes and other blemishes culled out, kiln-dried at eight percent, or less moisture, waterproof glue, machined, sanded, and finished with NSF-approved oil-sealer.

O. High Density Particle Board: Where indicated in counter or cabinet construction, provide high-density particle board.

1. F.E.C. shall provide fire rated material where required by code.

2. This shall be done at no additional expense to the Owner. F.E.C. shall determine if this is required or not.

3. Any permanently installed counters that use composite wood and agrifiber products shall contain no urea-formaldehyde resins.

P. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

1. F.E.C. shall provide fire rated material where required by code.

2. This shall be done at no additional expense to the Owner. F.E.C. shall determine if this is required or not.

Q. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

Colors and Patterns: As selected by Architect from manufacturer's full range.

R. Quartz Material: Commercial grade, 3 CM, unless otherwise indicated.

Colors and Patterns: As selected by Architect from manufacturer's full range.

S. Plywood: Where cabinet or counter construction calls for plywood, use birch grade paint finish standard or grade as indicated. For composite wood products, provide manufacturer’s product data indicating that product has low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins (NAF).

Provide composite wood products that have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins (NAF).

T. Sound Deadening: Sound deaden underside of table with premium type mastic, that "skins" on surface when dry. Surface of mastic coating shall be smooth, equal to the standard for hot-rolled steel finish, 3M Coating #1000 E/C or equivalent.

1. Apply two (2) coatings of sound deadening material to underside of tops, drain boards, dishtables, counters and sinks.

2. Apply sound deadening during fabrication. Touch up on project site if required.

U. Gaskets: Solid or hollow (not cellular) neoprene or PVC; light gray, minimum of 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.

V. Rapidly Renewable Materials: Rapidly renewable materials used such as bamboo, agrifiber, linoleum, wheatboard, strawboard, or cork specified in the project must be harvested in a 10-year life cycle or shorter.

2.3. MANUFACTURED OR FABRICATED COMPONENTS

A. Wall Anchors: Wherever it is necessary to mount fixtures that are supported from the wall, the fixtures shall be securely attached thereto by means of stainless-steel tapped screws into stainless-steel face and anchor type grounds that are built into the walls. Furnish these grounds to other trades at proper time so other trades can build them into the walls as work progresses. Item Specifications note fixtures requiring such grounds. It is the responsibility of the F.E.C. to coordinate and provide these anchors in a timely manner.

B. Floor Anchors: Wherever it is necessary to mount fixtures to the floor, the fixtures shall be securely attached thereto by means of stainless-steel tapped screws.

C. Faucets: Furnish all faucets including spray rinse units and wall brackets. All faucets to include spring checks. Drill and finish fixtures in preparation for installation. Provide loose to installing contractors. Faucet nozzles are to be centered over sink drain. If faucet is not specified, provide as follows:

1. Built-in hand sink faucets: Deck mounted faucets with 4" centers shall be T & S Brass & Bronze Works B-1141-XSCR4V05 or approved equal, ½" inlet.

2. Deck mounted faucets with 8" centers shall be T & S Brass & Bronze Works B-0221-CR or approved equal, ½" inlet. Faucet nozzle length to be centered over sink drain.

3. Backsplash mounted faucets shall be T & S Brass & Bronze Works B-0231-CR or approved equal, ½" inlet. Faucet nozzle length to be centered over sink drain.

4. Potsink faucets shall be T & S Brass & Bronze Works B-0290-01 or approved equal, 3/4" inlet. Faucet nozzle length to be centered over sink drain.

5. Wall mounted pot and kettle filling faucet for dual temperatures shall be T & S, B-0598-CR and for single temperature shall be T & S, B-0594-CR, ½" inlet.

6. Built-in dipper well, faucet and sink shall be T & S, 2282-01-F05 or approved equal.

7. Pre-rinse faucets: deck mounted shall be T & S, B-0113-12CRBJST low flow and splash mounted shall be T & S, B-0133-12CRBJST low flow or approved equal. Faucet nozzle length to be centered over sink drain.

8. Other faucets such as swing spouts for kettles, et cetera, are also included in this contract. Types required will be stated in Item Specifications.

D. Potable Water Protection & Vacuum Breakers: Furnish all protection devices unless otherwise indicated in the Project Documents. Drill and finish fixtures in preparation for installation. If exposed, provide chrome plated model. Provide loose to installing contractors.

1. Air Gap: The distance of a water inlet or opening above the maximum high-water level or overflow rim in a fixture, device, or container. A “safe air gap” is at least 2 times the diameter of the water inlet pipe, but not less than 1 inch and need not be more than 12 inches.

2. Reduced Pressure Principle Device (RPZ): It consists of 2 independently acting internally loaded check valves separated by a reduced pressure zone. A differential pressure relief valve is located within the zone to maintain the reduced pressure and also discharge water to atmosphere during periods of backflow. This device is used as protection for all direct or indirect cross connections. The device may be subject to back pressure or back-siphonage of toxic chemicals, sewage, or other lethal substances.

3. Pressure Vacuum Breaker: This device allows air to enter the waterline when the pressure in the public system or the service line is reduced to 0 psi or below. The device has a vacuum relief valve which is internally loaded, normally by means of a spring. May be installed for use under continuous line pressure. Must be installed at least 12" above the highest outlet it is to serve.

4. Atmospheric Vacuum Breaker: Allows air to enter the waterline when the pressure in the public system or the service line is reduced to 0 or below, however, since the vacuum relief is not internally loaded the device must be installed on a discharge side of the shut off valve. Should not be subjected to continuous flows for periods of more than 12 hours and must be installed at least 6" inches above the highest outlet it is to serve.

5. Double Check Valve Assembly: Consists of (2) two independently acting internally loaded check valves. This device may be used for back pressure or back-siphonage situations, only if the cross-connection protection is from substances that do not constitute a health hazard.

E. Rotary Waste Valves: Provide two-inch, heavy cast-bronze body; removable flat stainless-steel strainer; twist handle waste outlet and one-piece connected chrome-plated brass overflow, unless otherwise stated in the Item Specifications. Provide waste and overflow by Fisher Faucets, 6100 series or approved equal.

F. Casters: Provide four-inch minimum diameter wheel casters, with 1-1/8-inch tread width, conforming to NSF standards, unless otherwise noted in Item Specifications. Provide sealed, self-lubricating bearings, cadmium-plated or bright zinc-plated steel disc wheels and solid synthetic rubber tires. Provide foot brakes on (2) two casters per unit unless otherwise specified.

2.4. ELECTRICAL REQUIREMENTS - GENERAL

A. Electric Equipment: The F.E.C. is responsible to provide equipment with electrical requirements matched to that of the building facility. Verify electrical requirements of all new and existing equipment. The F.E.C. will be responsible for all costs of restocking and returning equipment that is not matched to the requirements of the building.

B. Wiring: All wiring provided under this contract shall be in full accordance with the latest edition of the National Electrical Code. Further, all wiring provided shall be contained in a metallic raceway, approved by engineer, consisting of a specially fabricated wire-way as in the case of work built into counter work, or in conduit of proper material, or Greenfield flexible conduit, all with necessary provisions for grounding continuity. All conductors provided shall have proper temperature ratings. Any exposed conduit shall be covered in a smooth, chemical resistant and sealed covering. Any wiring needing to run in conduit visible to customers or on exterior of walls/cabinets but must be in stainless-steel conduit or chrome plated.

C. Thermal Overload Protection: All motors of equipment provided shall have the thermal overload protection provided.

D. Control Equipment: Provide all necessary electrical control equipment and internal wiring (if available as factory wired), except as otherwise outlined, mounted on equipment where practicable or where shown on plan.

E. Receptacles: Receptacle manufacturer shall be the same manufacturer that will be used on the balance of the project. Contact the Architect to determine which manufacturer is to be used. The following standards are intended to be the minimum standard for the products: Provide Bryant 5261, where single, and 5262, where duplex, with matching caps on associated equipment as Bryant 5266; 30-amp outlets shall be 4 wire Hubbell 20403 receptacles, with matching cap Hubbell 20415 on associated equipment. All receptacles shall have ground fault circuit interrupter unless indicated on equipment cutsheet to not provide. All receptacle to have grounding conductor.

1. Receptacles larger than 30 amperes shall be Hubbell 60 ampere 9-1059 porcelain face with matching cap, 3 wires, and 7714 brass chrome plated or stainless-steel face plate.

2. Receptacles for 240 volts shall be 3 or 4 wires as required, of twice normal capacity. Twist-lock receptacles to be Hubbell 7310 with matching cap 7311. All caps to be for heavy duty applications. All receptacles to have grounding conductor.

3. Receptacles for cashier's stands to serve cash registers shall be on a dedicated circuit.

4. All receptacles shall have stainless-steel face or matching face color to match surface mounted on.

F. Cover Plates: All receptacles to have 1040 stainless-steel or chrome plated brass cover plates with stainless-steel or chrome plated brass screw for all outlets provide in equipment.

G. Cords: Flexible cords to be provided on equipment shall have grounding conductor and shall be of best quality available to industry, equal to Simplex-Tryex, selenium neoprene.

H. Motor Starters: Provide required starters for all motors. Motor starters required for foodservice equipment and not provided by Other Trades shall be thermal overload

protective type, manual wherever possible, equal to New Series Allen Bradley Bulletin 709 magnetic with necessary accessory equipment where required for proper operation. Where required fully magnetic type W.P.B. station shall be furnished. All manual and magnetic type motor starters provided under this contract for 3 phase motors shall be 3 thermal element type, requiring special coordination with starter manufacturer.

I. Motor Thermal Protection: In instances in which motor thermal protection cannot be built-in where specified into motors provided with equipment, the F.E.C. shall provide externally mounted overload devices of proper number of poles and capacity equal to Turnbull "TT" or Allen Bradley and shall carry wiring from motor terminals to these devices in manner approved by inspection authorities as being in full accord with applicable electrical codes and engineers plans.

J. Wire: Verify with the C.M., in writing, the appropriate wire types for pre-wired equipment. Except as otherwise required, all wire provided shall be type THW dual rating. Wire in counter raceways to be heat resistant type, AVA or equal.

K. Openings: Provide proper openings through all equipment and shelves for piping and electrical conduits. All openings are to be located as close to the rear of the counter and sized just big enough for the pipe or wire. All openings shall be smooth, so not to damage or cut the piping or electrical wires.

L. Panel Boards: These shall be UL listed and properly sized in compliance with current or prevailing version of the National Electric Code.

M. Floor Based Electrical Connections: These shall be made in a manner that will allow portable equipment connected to the floor electrical supply to pass over the point of connection without interference.

N. Code Compliance: All electrical work to be performed in accordance with the prevailing version of the National Electric Code and local regulations.

O. Other Conditions: If not specified as provided by other contractors, F.E.C. to provide all electrical parts including but not limited to contactor strips, line shunts, relays, disconnects (both mechanical and electrical), loose parts and labor required for installation of same not provided by other contractors and pertinent to the installation of equipment under this section. A non-limiting example of this type of equipment would be contactor strips required for the proper operation of fire protection systems.

2.5. STEAM PRESSURE, STEAM THERMOSTATS, STEAM COILS

A. Steam Pressure: All steam operated pressure vessels such as kettles, steamers, urns, et cetera, shall be constructed to A.S.M.E. and the Code requirements of the State in which the project occurs and shall bear labels and certificates of compliance therewith.

B. Steam Thermostats: Provide steam thermostats or temperature regulators for steam heated equipment if required for proper operation of the piece of equipment or if required in the Item Specifications.

C. Steam Coils: All steam coils shall be installed in sufficient quantity to provide ample heat at the available steam pressure (verify project conditions). They shall be tested for 100 pounds per square inch working pressure.

1. In fixtures having coils under more than one shelf, all coils shall be connected together with inlet and outlet extended down through base of fixture to point indicated on drawings for installation of stop valves and final connection.

2. Unless otherwise specified, coils are to be 7/8" O.D. hard copper tubing with brass fittings. Where immersed in water, coils are to be mounted on strap type brackets or feet with a clearance of not less than 1" below coils for cleaning purposes. These feet are to be soldered water-tight to the bottom of the pan in which coils are mounted. Couplings shall be welded or braised in the bottom or sides of fixtures for steam inlet and outlet and shall extend through fixture ready for final connections.

3. Boiler permits shall be acquired by the installing contractor and all fees shall be paid by the installing contractor.

2.6. LOCKS

Cabinets and Refrigerated Units: Provide integral locks on all cabinets and refrigerated units. Locks shall be of sufficient strength to prevent unauthorized entry into the locked space. Locks shall be of the key and cylinder type with tamper-proof mechanisms. Furnish Owner with three (3) sets of keys to each lock at the conclusion of the project, accurately labeled and turned over to the Owner all at one point in time. This lock standard applies to all cabinets unless otherwise indicated in Item Specifications.

2.7. FABRICATION, GENERAL

A. Welds: All workmanship shall be done with welded rod of same composition as sheets or parts welded. Welds shall be strong, ductile, with excess metal ground off, and finished smooth to match adjacent surface. Welds shall be free of imperfections as pits, runs, spatter, cracks, et cetera, and shall have the same color as adjacent sheet surfaces. All joints in top fixtures, tables, drain board, exposed shelving, sinks, et cetera, shall be electrically welded. Butt welds made of spot-welding straps under seams and filling in with solder will not be acceptable. It is the intention of these specifications that all welded joints shall be homogeneous with the sheet metal itself. Where sheet sizes necessitate a joint, such joint shall be welded. Tops of fixtures shall be fabricated at the factory with welded joints to reduce field welding.

B. Under no circumstances are any welds to be spray painted. All welds are to be ground and polished smooth.

C. Field Joints (Welded): Where field joints are necessary, the tops shall be continuous. Items shall be made in maximum length sections as possible and with as few joints as necessary. Provide proper joint preparation and location. Access shall be provided, where possible, to the back side of the welds. Joints shall be located to provide the minimum length of seam. Field joints are to be provided only for the convenience of

installation and shall be held to an absolute minimum. Show proposed field welds on shop fabrication drawings.

D. Field Joints (Bolted): Bolted field joints, if specified as acceptable, are to be drawn tight leaving a hair-line seam and shall not have any exposed screws or rivets. Joints shall be neatly and carefully fabricated to make the very best appearing joint possible. After equipment is set in place, all field joints shall be tightly pulled together leaving only a hair-line seam. The alignment of the joints shall be made in such a manner that they shall be tightened both horizontally and vertically. Show proposed bolted field joints on shop fabrication drawings.

E. Surfaces: All surfaces shall be completely free of burrs, rough edges, slag or any other debris.

F. Other Exposed Surfaces: All coved corners, legs, table tops and all other exposed surfaces to be ground smooth and polished to a #4 finish.

G. Exposed Joints: All exposed welded joints including field joints shall be suitably ground flush with the adjoining material and neatly finished to harmonize and appear the same.

H. Depressions: Wherever material has been depressed or sunken in by the welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again ground to eliminate low spots. All ground surfaces shall then be polished or buffed to match adjoining surfaces consistent with good workmanship.

I. Discoloration: Care shall be exercised in all grinding operations to avoid excessive heating of the metal and metal discoloration. In all cases the grain of rough grinding shall be removed by successive finer polishing operations.

J. Finished Texture: The texture of the final polishing operation shall be uniform and smooth consistent with reasonable care and good workmanship. The general finish of all metal shall be of high grade.

K. Brake Bends: Wherever brake bends occur, they shall be free of open texture or orange peel appearance; and where such brake does not mar the uniformity of the appearance of the material, all such marks shall be removed by suitable grinding, polishing and finishing.

L. Sheared Edges: Wherever sheared edges occur, they shall be free of burrs, projections, and fins to obviate all danger of cutting and laceration when the hand is drawn over such sheared edges.

M. Miters and Bullnose Corners: Where miters or bullnose corners occur, they shall be neatly finished with the under edge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable.

N. Finish: It is the intention of these specifications to describe fabrication of a quality finish consistent with the highest grade of manufacturing practices in the industry. Edges of tops and over-shelves shall be highly polished or mirrored finish where required by the Item Specifications. Final approval of surface finishes shall be by Architect.

2.8. PIPING AND PIPE CHASES

A. Drain Size: All drains shall be specified and sized to handle the maximum load and temperature. The minimum size of any floor drain shall be 3”.

B. Coordination of Drain Locations: All equipment and drain locations must be carefully coordinated between the F.E.C. and the M.C. in order to assure that equipment legs are not on top of any part of a floor drain, floor sink or floor trough.

C. Pipe Chase Panels: Where top arrangement of enclosed base tables makes it necessary for plumbing and supply piping to be passed through the base, this piping shall be enclosed in a suitable pipe chase with easily removable access panels. These access panels are not to be held in place with screws or latches but are to be formed up in a pan shape, removable without the use of tools. The foregoing only applies to fixtures where an access is required from the front of the fixture, as in the case of pipe chases at end of fixtures containing bottom and intermediate shelves need not be enclosed unless specifically called for in the Item Specifications. Unless otherwise specified, shelves in these fixtures will be turned up a minimum of 3" at the edge of the pipe chase.

D. Access Panels: Where access panels are specified, the panels shall be used for access to drains and electrical junction boxes only. The access panels are used for cleaning and maintenance only. They shall not be used for electrical, plumbing, chases and rough-in penetrations. The access panel shall be made of matching material and removable without tools.

E. Consult with Piping Contractors: In detailing fixtures, consult with piping contractors to be certain that due space allowance is made for traps and other controls, particularly under lower shelves.

F. Shelf Penetration: Where plumbing and supply piping pass through shelves on open base tables, shelves shall be neatly punched or die-stamped for the piping. Show the location of such pipe chases or stamped pipe openings, on plan and/or detail drawings. Provide sufficient size to accommodate all necessary risers so that additional holes need not be cut in the field. Coordinate with plumbing contractors, cautioning them that all piping must be run through chases or slots as provided.

G. Utilities Housing: All utilities for counters and fabricated equipment will be housed in chases constructed for same, pre-wired to minimize field wiring and plumbing.

H. All exposed tubing, ductwork, ventilation, insulation etc that is connected to foodservice equipment and is visible to customers’ needs to be clad in 304 stainless-steel. Minimal seams for cladding.

2.9. SANITARY CONSTRUCTION

Approvals: All fabricated equipment is to be constructed in strict compliance with the latest applicable food equipment and equipment construction standards of the National Sanitation Foundation and shall be in full compliance with the Public Health Regulations of the locality in which the installation is to be made. All fabricated equipment shall have the seal of approval of the National Sanitation Foundation and, if required by code, a UL seal of approval.

2.10. SINKS

A. Construction: Sinks and frames shall be constructed of 14-gauge stainless-steel. The front shall extend up 2-3/4" higher than the drain board line and shall be finished with a 1-3/4" wide channel rim, running full length, with ends of sink frame constructed for welding to drain boards where such are specified. Sink bowls, unless otherwise indicated in Item Specifications, shall be 14-gauge stainless-steel fully welded to frames so that no joint is visible. Where required, provide sinks with drain boards, backsplashes, heaters, or water circulation systems.

1. Where drain boards are required, they shall be electrically welded to the sink frame to provide an integral unit.

2. Where the sink is free standing without drain boards, the channel rims shall continue around both ends with the corners of the channel edge rounded to conform with the radius of the inside vertical corner of the sink. Corners shall be electrically welded.

3. Where a backsplash is required, the rear of the backsplash shall extend to the specified height above the drain board work surface, with the top edge returning to the wall at a 45-degree angle and forming a 2-1/4" clear pipe chase.

4. The ends of the sinks shall be electrically welded to the body of the sink with all vertical and horizontal corners formed on a 3/4" radius with welds ground and polished smooth to a #4 finish.

5. Bottom of sinks shall be depressed and slope to a twist handle waste with handle constructed of 3/8" stainless-steel rod extending to the front of the sink. This twist handle drain shall have a built-in connection for an overflow pipe. Rear of overflow connection to have a polished nickel alloy front plate and shall be completely connected to the drain with nickel plated brass tubing. The Twist handle shall be supported by a stainless-steel bracket welded to the underside of the sink.

6. Provide at top center rear of each compartment, below the drain board line, a polished cast nickel bronze overflow with 1-1/4" O.D. brass tubing connection to outlet at back of drain.

7. Where multiple sink bowls are welded to a frame, a minimum 2" between bowls shall be provided to prevent temperature transfer.

8. Where sinks are specified to set into countertops, the sinks shall be electrically welded to top with continuous weld, ground smooth so that no seam is visible and surfaces match. Drop-in sinks with hardware fasteners will not be accepted unless specifically called for in the Item Specifications.

9. All interior and exterior horizontal and vertical bonds and corners shall be rounded on a 3/4" radius with all joints welded.

10. Mount fill faucets in backsplash. Single compartment sinks shall be fitted with two (2) holes on 8" centers over the center compartment. Where sinks have two or

more compartments, provide two (2) holes on 8" centers over the partition(s). Fit sink(s) with combination chromium plated swing spout faucet(s).

B. Drain Boards: Construct of 14-gauge polished stainless-steel welded integral to the body of the sink with continuous rolled rims and splash of the same height and design as the sink. Roll rim heights at the shallow end shall be 1" high sloping approximately ½" to the sink body, unless otherwise specified. All drain boards shall have horizontal corners coved on 1/4" radius with the vertical corners coved on 1/4"radius. Drain boards must slope in the direction of the sink, so water will not pool.

C. Legs: Sink legs shall be as specified under "Table and Sink Legs". Legs shall be attached with a 14-gauge stainless-steel gusset to the underside of the sink body. The gusset shall be conical shaped and provided with an Allen head dog point set screw.

D. Additional considerations: Where so indicated by the Item Specifications, provide sinks as follows:

1. Where "plug and chain drain" is specified, sink bowls shall slope to a drain which shall be a standard 1-1/2" drain with plug and chain.

2. Where "basket strainer drain" is specified, sink shall be fitted with a 1-1/2" cup strainer assembly.

3. Where "sink compartment heater" is specified, sink compartment shall be heated with electric immersion elements with low water cutout and thermostatic control, as manufactured by Hatco or approved equal and of sufficient wattage to assure 180-degree Fahrenheit rinse water.

2.11. COUNTER AND TABLE TOPS - METAL CONSTRUCTION

A. Tops and Edges: Counter and table tops shall be fabricated with type of edge as specified. The definite choice as to the type of edge profile to be used shall be made before the time of bidding. All tops, unless otherwise specified, shall be 14-gauge stainless-steel. If quartz top is specified, install with a hard seam installation. No seams shall be through any heated or cold pieces of equipment. Verify location of seams with architect and Bakergroup.

B. Top Bracing: Tops shall be braced with 1-1/2" x 1-1/2" x 1/8" galvanized angles and 1-1/2" x 3" x 1-1/2" 14-gauge galvanized channels. On open base tables, one channel shall be placed at each pair of legs. A longitudinal angle shall be placed between the channels for additional top support.

C. Underbracing: Underbracing, will be constructed of stainless-steel channels, size same as in 2.11 A & 2.11 B above. When stainless-steel underbracing is utilized, the above sized channel will be used throughout for underbracing.

D. Top Fastening: Tops shall be fastened to the framing members with protruding studs. Studs shall be welded to the underside of the table top and fastened by means of chrome plated lock washers and acorn nuts.

E. Backsplashes: Backsplashes shall be of the height specified with the standard height being 2" on serving counters, 6" overall on worktables and 10" on dishtables. The splash shall be returned 2" on a 45o angle. All corners of tops formed by bending and/or welding shall have a radius of 3/4".

2.12. SOUND DEADENING

Application: Apply sound deadening material to all tables, counters, sinks, et cetera per section 2.2.

2.13. TABLE AND SINK LEGS

A. Materials: All legs for open base tables, sinks and dishtables shall be constructed of stainless-steel, 14-gauge, seam welded and polished to a #4 finish, unless otherwise specified. Cross rails, where required, shall be of 1-1/4" 14-gauge wall welded tubing of stainless-steel. Cross rails shall be welded to legs with the resulting welds ground and polished to a smooth finish. All legs shall be fitted with a stainless-steel adjustable bullet foot having a minimum of 1" adjustment. All feet furnished shall be vermin proof having closed bottoms of stainless-steel with unexposed threads and a minimum clearance between the foot and the leg of 1/32".

B. Tops: Tops of legs shall be welded to 14-gauge stainless-steel section of channel, closing top of leg, and this channel section shall be sized to nest inside table reinforcing channel and then is bolted in place with stainless-steel bolts and lock washers through both vertical channel legs and gusset if open leg type table. Wherever threads of bolts and screws on the inside of fixtures, which are either visible or might come in contact with the hand or wiping cloth, such bolts and screw threads shall be capped with suitable lock washer and chrome plated brass or bronze acorn nut. Where screw threads are not visible or readily accessible, they might be capped with a standard lock washer and steel nut treated to prevent rusting or corroding.

C. Gussets: All gussets shall be fully enclosed stainless-steel and provided at all leg locations. These gussets shall be one hundred percent (100%) welded to channels in a water-proof, vermin-proof manner. Where gussets occur at angle iron framework, provide triangular 12-gauge stainless-steel corner plates, welded to bottom edge of angle frame and weld gusset to triangular plate. These gussets shall have 16-gauge stainless-steel exterior case complete with galvanized interior case. Legs shall slip fit into internal case and be held in place with stainless-steel set screw.

D. Cabinet and Warmer Legs: All cabinets, warmers and/or other enclosed bodies unless otherwise specified are to be mounted on round pattern adjustable legs. Legs shall be of 1-5/8" o.d. stainless-steel seamless tubing having a stainless-steel adjustable bullet shaped foot with a minimum of 1" of adjustment. Legs shall not be less than 6" high overall. Legs shall be welded to a 14-gauge die-formed stainless-steel mounting plate. This plate shall telescope into a 14-gauge galvanized channel welded to the underside of the body. This channel shall extend the full length of the cabinet. The leg mounting plate shall slide in the channel to permit relocation and removal of the leg. The die forming plate shall have a center embossing for the 1-5/8" o.d. leg tubing and shall have a clinch nut inset screw for locking the leg in place.

E. When to Omit Front Cross Rails: Only where indicated, legs are to be without lower tubing cross-bracing in order to provide space for mobile item storage.

F. Lower Shelves: Where lower shelves are specified, these shelves shall be permanently welded to legs, except when removable shelves are specified, and the stainless-steel tubing cross rails will be omitted.

G. Quantity: Unless otherwise specified, tables and open base fixtures up to 6'-0" in length shall have four (4) legs. Tables from 6'-0" to 12'-0" in length shall have six (6) legs and tables from 12'-0" in length to 18'-0" in length shall have eight (8) legs or more as required to make a substantial fixture to accommodate special construction.

2.14. CABINETS - BASE UNITS, METAL CONSTRUCTION

A. Construction Standards: To be constructed to standards indicated in Section 2.2 of these specifications. All casework to be stainless-steel construction, unless otherwise noted.

B. Countertops: All countertops to be 14-gauge stainless-steel, unless noted otherwise. Provide square rim edge, unless noted otherwise. 4" high splash at all back and side walls, unless noted otherwise. Countertops to be constructed to sizes and profiles shown on plans.

C. Support: Cabinets to be constructed to support all equipment, materials, utilities and products without deflection at any point. All cabinets having a clear span below shall be capable of sustaining 300 pounds of live weight at any point without deflection.

D. Base: All cabinet bases shall be mounted on adjustable stainless-steel legs with bullet feet. All base cabinets shall have a 6" high toe space and, if a cove base is anticipated, a vertical stainless-steel toe kick, removable and suitable as finished surface or as a surface to which a finished base may be applied by contractors other than the F.E.C. Cabinet bases shall have adequate structure to mount, support and rigidly hold a toe kick in place. Applied surfaces shall be applied in sizes that minimize the number of seams required. Show proposed seam locations on your shop drawings. Seam locations must be approved by Design team.

E. Hardware: The following casework hardware is specified to establish the desired design and level of quality. Alternative manufacturers of equivalent products may be used. Casework fabricator shall utilize the correct quantity and spacing of hardware items as recommended by the specific manufacturers:

1. Door Hinges: Blum 110 degree concealed blumotion, screw-on, self-closing hinges. Provide minimal of 3 hinges per door. Increase hinges per door if weight of door exceeds 50 lbs. Provide with stainless-steel hinge arm cover cap and cup cover cap to match hinges (no logos). For approved equivalent hinge, provide sample to architect and Bakergroup for approval.

2. Provide in all locations concealed handle Epco – DP40-A, Aluminum, Satin clear anodized. For approved equivalent handle, provide sample to architect and Bakergroup for approval.

3. All hinges and door catches shall be rigidly mounted to casework. Provide any additional support as needed.

F. Shelves: Provide shelving per Section 2.17 of these Specifications.

2.15. CABINETS - BASE UNITS, MILLWORK CONSTRUCTION

A. Construction Standards: All casework to be constructed to standard indicated in Section 1.9 G of these specifications. All casework to be plastic laminate construction, unless otherwise noted. All plastic laminate cabinets are to be one color, unless otherwise noted. All cabinets shall utilize flush overlay construction.

B. Countertops: All countertops to be as indicated on plans. Provide 1-1/2" shelf edge and 4" high splash at all back and side walls, unless indicated otherwise. Countertops to be constructed to sizes and profiles shown utilizing colors and finishes; provide fusion seaming where available. Locate seams to minimize evidence of seaming.

C. Support: Cabinets to be constructed to support all equipment, materials, utilities and products without deflection at any point. All cabinets having a clear span below shall be capable of sustaining 300 pounds of live weight at any point without deflection.

D. Base: All cabinet bases shall be mounted on adjustable stainless-steel legs with bullet feet. All base cabinets shall have a 6" high toe space and, if a cove base is anticipated, a vertical stainless-steel toe kick, removable and suitable as finished surface or as a surface to which a finished base may be applied by contractors other than the F.E.C. Locate seams to minimize evidence of seaming. Cabinet bases shall adequate structure to mount, support and rigidly hold in place toe kick. Applied surfaces shall be applied in sizes that minimize the number of seams required. Show proposed seam locations on your shop drawings. Seam locations must be approved.

E. Hardware: The following casework hardware is specified to establish the desired design and level of quality. Alternative manufacturers of equivalent products may be used. Casework fabricator shall utilize the correct quantity and spacing of hardware items as recommended by the specific manufacturers:

1. Door Hinges: Blum 110 degree concealed blumotion, screw-on, self-closing hinges. Provide minimal of 3 hinges per door. Increase hinges per door if weight of door exceeds 50 lbs. Provide with stainless-steel hinge arm cover cap and cup cover cap to match hinges (no logos). For approved equivalent hinge, provide sample to architect and Bakergroup for approval.

2. Provide in all locations concealed handle Epco – DP40-A, Aluminum, Satin clear anodized. For approved equivalent handle, provide sample to architect and Bakergroup for approval.

3. All hinges and door catches shall be rigidly mounted to casework. Provide any additional support as needed.

2.16. QUARTZ-MATERIAL COUNTERTOPS

A. Grade: Commercial or as shown per details

B. Solid-Surfacing Material Thickness: 3 CM unless otherwise designated.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of quartz material complying with the manufacturer's designations in the architectural finish schedule.

D. Fabricate tops in one piece, unless otherwise indicated. Seam lines must be coordinated with design team. Comply with quartz-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing. Fabricate tops with shop-applied edges of materials and configuration indicated.

E. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

F. Install integral sink bowls in countertops in shop.

2.17. SHELVING (METAL)

A. Removable shelving shall be provided for all counters, cabinets, casework, worktables and equipment stands unless otherwise specified. If under-shelving is not specified provide all tables, dishtables and sinks with tubular under-shelves running the full length of unit. Shelving should be in sections of 20" wide or less. Must be able to fit through dishmachine or fit in 3 compartment sink.

B. Stationary Shelving: Stationary shelving under open base tables shall set approximately 8" above the floor with all edges rolled down on a 3/4" radius approximately 1-3/4". The profile of these shelves shall be as shown in details. Where shelving intersects the leg, the joint shall be formed without openings. The shelving shall be attached by welding the underside. Where shelving abuts walls, turn edge up 2", round corners and finish smooth.

C. Removable Shelving: Removable shelving under open base tables will be supported on 1-1/4" stainless-steel tubing. The resulting shelving shall be rolled down over the rails in maximum 20" wide sections. Where shelving abuts walls, turn edge up 2", round corners and finish smooth. Shelves shall be turned down 90 degree square where the resulting sections abut one another. Shelving should be in sections of 20" wide or less. Must be able to fit through dishmachine or fit in 3 compartment sink.

D. Tubular Shelves: Tubular shelving under open base tables will be set approximately 8" above the floor on 6" centers. Where shelving intersects the leg or a cross brace, it shall be fully welded and polished smooth; the joint shall be formed without openings.

E. Enclosed Shelving: Enclosed cabinet shelving shall be of 18-gauge stainless-steel, back and ends turned up 1-1/2" against body panels and spot welded. Front edge shall be

turned down 1-1/2" and returned ½" on 75-degree angle on intermediate shelf. Lower shelf to be turned down 1-1/2" on front and back 11/16".

F. Enclosed Shelving, Construction: Enclosed cabinet removable shelving shall be made in maximum 20" wide sections having all edges flanged down 1-1/2". The corners of these shelves shall be left open so as to provide an easy to clean corner. Heated cabinet shelves shall be perforated with ½" diameter holes spaced on 3" centers. These shelves shall be removable and supported on angle framework as specified.

G. Elevated Shelving: Elevated shelving 12" wide or less shall be made of 16-gauge stainless-steel. Elevated shelving more than 12" wide shall be made of 14-gauge stainless-steel. The front and ends shall be rolled down on a 3/4" radius - 1-1/2" diameter; roll approximately 180 degrees. This shall be metal edge profile as shown per details. Where shelves are up against the wall or adjacent to fixtures, the edges shall be turned up 1-1/2". All flanges shall be coved on a minimum 1/8" radius with the intersecting turned up flanges at the back and ends also coved. The corners shall be welded, ground and polished to form a fillet of the same radius as other bends.

H. Table Mounted Shelves: Table mounted shelves shall be supported from the top of the fixtures on 1- 1/4" o.d. diameter stainless-steel tubular uprights attached to the shelving with stainless-steel feruled plates and/or stainless-steel triangular brackets. The feruled plates shall be spot welded to the underside of the shelves and the stainless-steel brackets shall be attached with stainless-steel studs, lock washers and acorn nuts. Tubular supports shall be attached to the countertop without visible bolts and/or screws. It is extremely important that on dishtables the supports be located so as not to be placed in working areas. Supports on dishtables shall be extended through the return of the backsplash to a bracket below the working surface of the table. This bracket, whenever possible, shall be bracketed to an existing table leg.

2.18. VENTILATION OF COUNTERS, CABINETS & CASEWORK

F.E.C. shall provide, as an integral part of all counters, cabinets, or casework containing equipment with undercounter compressors or other heat-producing undercounter equipment, forced air ventilation fan equipment as required to maintain proper operating temperatures for the counter mounted and undercounter equipment and properly ventilate the counter cavity. The fan units shall be pre-wired by the F.E.C. to function simultaneously with the operation of the undercounter and counter mounted equipment. Where a ventilation grating is provided, F.E.C. shall provide and install a stainless-steel duct between the fan unit and the ventilation grating. To the extent possible, fan unit(s) shall be hidden from customer sightlines and shall be the quietest unit(s) available for the purpose.

2.19. WALL SHELVING

Stainless-steel Wall Mounted Shelves: Wall mounted shelves shall be supported on 14-gauge stainless-steel cantilever type brackets. These brackets shall be steady and shall be provided with two holes for securely anchoring to the masonry at the job site. Triangular shaped brackets shall be attached to the underside of the shelf with studs, lock washers and chrome plated acorn nuts.

2.20. BREATH PROTECTION

A. Breath Protection: Breath protection shall be of the size shown on plan and shall be approved by design team and Health Department codes and standards.

B. Top Shelf: Top shelf shall be 16-gauge stainless-steel with the front being formed down on a slope to match the slope of the front glass and bracket. The rear and ends of the serving shelf to be turned down 1-3/4" on a 90 degree angle. The rear edge of the shelf shall be returned approximately 1". This channel shall form a housing for a built-in LED light or heat lamp, where so specified. This channel shall accommodate Tombstone type lamp holders which shall have the wiring completely enclosed and extended through tubular support into the base of the fixture, to a remote switch. All corners of the shelf shall be welded, ground and polished smooth. The protector shelf shall be approximately 16" high.

C. Uprights: Shelf shall be mounted on 16-gauge round stainless-steel uprights unless otherwise specified. The uprights will be designed so as to be adjustable up or down 8", in a concealed manner without visible means of attachment.

D. Glass Units: Provide with a removable polished stainless-steel trim for holding the glass. This trim and bracket shall be provided with a cushioning material so as to prevent glass from cracking when it is being fastened in place. Front glass to be as shown in details tempered glass. The end of the protector shelf shall be enclosed with minimal 3/8” thick polished plate glass. Non-tempered glass requires all unfinished edges to be covered completely in stainless-steel trim. Trim is to be completely welded, with no rough or unpolished edges or seams.

E. Lights: Where lights are specified under the item, a base mounted switch will be provided. This switch shall be mounted in a recessed stainless-steel pan, located on or in counter as directed by design team. A ballast and ballast box shall be provided in the base of the counter as required.

F. Heat Strips: Where heat strips are specified under the item, remote infinite controls will be provided. These controls shall be mounted in a recessed stainless-steel pan, located on or in counter as directed by design team. A ballast and ballast box shall be provided in the base of the counter as required, provided by F.E.C.

2.21. DRAWERS

A. Construction: All drawers shall be 18-gauge stainless-steel body measuring 20" x 20" x 5" deep or of size called for in Item Specifications. Provide set of three stacked drawers, unless otherwise indicated.

B. Insert: Drawer pan insert shall be constructed of stainless-steel and die-stamped with bottom corners rolled on a 1" radius and vertical corners rounded on a 2" radius, removable without the use of tools, measuring 20" x 20" x 5" deep or of size called for in Item Specifications.

C. Slides: 14-gauge stainless-steel channel type slides formed with nylon tiered ball bearing rollers. Slide shall be of telescoping channels with a minimum of four rollers per pair. Slide shall be welded to the drawer face and cross bracing forming a cradle to accept the removable drawer body. This slide shall be pitched to allow the drawer to close via gravity. Complete drawer frame and slide assembly will be removable for cleaning. All slides shall be full extension.

D. Fronts and Pulls: Unless otherwise indicated, fronts or face shall be 16-gauge stainless-steel double pan construction with all sides turned back and the corners welded. The face shall be supplied with a stainless-steel recessed grip with hand pull, chrome plated pull. Double panel faces will be sound deadened and insulated. Front shall be attached to drawer body with brackets.

E. Locks: Locks will be supplied as specified in Item Specifications. Locks shall be of sufficient strength to prevent unauthorized entry into the locked space. Locks shall be of the key and cylinder type with tamper-proof mechanisms. Furnish Owner with three (3) sets of keys to each lock at the conclusion of the project, accurately labeled and all delivered at one point in time.

F. Bumpers and Stops: All drawers shall have rubber bumpers for quiet operation and shall have positive stops to prevent accidental withdrawal. Do not provide stick-on style bumpers.

2.22. WORK TABLE TOPS - WOOD CUTTING BOARDS

A. Wood Work Table Tops: Wood tops shall be of the highest quality northern grown hard rock maple. Thickness shall be as specified. Tops shall be constructed of selected strips of edge grain maple electronically bonded to exact dimension with one clear finely finished face. Hardwood curbs or riser to be supplied with 1" radius cove.

B. Cutting Boards, "Richlite": When "Richlite" cutting surfaces are specified, cutting boards will be N.S.F. approved phenolic fiber laminate tops under the trademark "Richlite." Coved risers are ½" thick with a ½" radius cove. Standard height of risers is 4".

C. Cutting Boards: N.S.F. approved thermoplastic tops and cutting boards can be used in areas where cutting or carving surfaces are required. Material shall not warp, crack, bend, chip, or peel. Material shall be high-density polyethylene; pure natural polypropylene; copolymer natural polypropylene. Material shall be acceptable to N.S.F., U.S.D.A. & F.D.A. specifications.

2.23. REFRIGERATED BASES

Controls: F.E.C. shall provide all switches, controls, valves, thermostats and all necessary hardware for a complete system.

2.24. FOOD WARMERS AND PLATE SHELF

A. Heating Wells: Electric food warmers consist of the number of wells as shown on plan. Heating wells shall be of one-piece die-stamped heavy gauge type 302 stainless-steel. Wells shall be heated with 1600-watt stainless-steel heating element connected to a

thermostat equipped with an off position. Each well shall have a pilot light indication when the well is on. Food warmers shall be installed into the countertop having a die-formed headed edge which shall flange down into the food well and be attached with stainless-steel flat head screws. The joint between the countertop and the food well shall be sealed with high temperature sealant to prevent any escape of vapors. Provide insulation around heated drop-in units per manufacturer's recommendations based on countertop material. Examples of insulation to protect from thermal stresses are Nomex and heat reflecting aluminum tape or high-density fiber glass insulation. Verify with countertop manufacturer before fabrication.

B. Food Well Controls: Food well controls shall be mounted on the operator's side of the counter or shall be mounted in a stainless-steel recessed panel below the plate shelf as required per Item Specifications. Food warmers are to be supplied in 115-208-230-volt electrical characteristics. Food wells are to be inter-wired terminating in two or three leads. Wire sizes shall be as specified and required under the National Electric Code.

C. Plate Shelf: Each food warmer, where required, shall be stainless-steel with a dish shelf mounted to the rear of the food wells and below countertop. This shelf shall be fabricated of 16-gauge stainless-steel and shall be approximately 9-1/2" wide front to back. This dish shelf shall be so formed in contour as per detail drawing providing apron for mounting of food well controls and pilots. The plate shelf will also provide a necessary electrical chase for all wiring. Note: If counter containing food wells is to be constructed so that dish carts will roll underneath, shelf is not to be constructed unless specified, and then constructed in such a manner so as not to interfere with the dish cart passage.

D. Drain Valve: All drain valves are to be mounted in a stainless-steel recessed pan mounted in the apron of the counter.

2.25. COLD PANS

A. Non-refrigerated Cold Pans: Shall be of the size shown on drawing. Cold pans shall have an interior liner of 20-gauge polished stainless-steel having all interior corners coved on a minimum 1/4" radius. The exterior of the cold pan shall be constructed of 18-gauge stainless-steel. The bottom of the interior pan shall be creased to 1" chrome plated drain. The bottom and sides of the cold pan shall be provided with a minimum of 2" foamed-in-place insulation. The foam insulation shall have a 1.9-pound density and shall have a "K" factor of 0.12. Where the countertop is turned down into the cold pan, the metal contact shall be broken with breaker strips. Provide cold pan with 1" condensate drain.

B. Refrigerated Cold Pans: Refrigerated cold pan shall be constructed as outlined above having stainless-steel interior pan covered with 3/8" o.d. copper refrigeration coils in a serpentine pattern approximately 2" o.d. fastened to the underside of the inner liner for mechanical refrigeration. These coils shall be die-formed and shaped so as to provide good contact between the copper coil and the stainless-steel liner. Conductive mastic will be applied between the coils and the liner so as to insure uniform transfer of heat from the pan to the coil. The exterior of the pan will be provided with a valve box for cold pan expansion valve. Extend coil leads to the refrigeration condensing unit. Cold pan controls are to be mounted in a recessed stainless-steel pan mounted where shown on plans or stated in the Item Specifications. Provide cold pan with 1" condensate drain.

2.26. WALK-IN REFRIGERATORS AND FREEZERS

A. Condensation Drains: Drain lines shall have a trap to prevent humidity from entering unit. Piping shall be mounted to walls with 1” stand-offs to allow for cleaning.

B. Freezer Compartments: Any drain lines located in freezer compartments shall be fully insulated and wrapped with heat tape to prevent condensation from freezing.

C. Temperature Sensing Probes: Temperature sensing probes shall be covered with a protective, perforated, stainless-steel cover, secured with stainless-steel thumbscrews. This cover shall completely protect all lines. This cover shall be designed to be tight to the wall(s) so that it will not interfere with the placement of rack storage devices. Sensing probe lines will be protected by a stainless-steel enclosure, secured to the walk-in with stainless-steel screws.

D. Panels and Panel Joints: Caulk will not be considered as an acceptable substitute for the tight fit of interlocking panels. Gaps of over 1/8” will not be acceptable. F.E.C. is alerted to make certain that joints are tight. Rework of the walk-in(s) necessitated by the failure of the F.E.C. to make certain that panels are straight, true, undamaged and tightly joined will be at the sole expense of the F.E.C.

E. Conduit runs: All conduit runs must run across the outside, top of the walk-in(s) and have minimal of 1" clearance from adjacent surfaces to allow for cleaning. All conduit runs shall be in stainless-steel.

F. Door hinges, handles and automatic closures: Provide metal units. Must be stainless-steel/chrome finished.

G. Condensing Unit racks: Rack shall be constructed of a minimum 3” x 3” angle iron frame. Rack shall have angle iron support arms at the rear for attachment to the building or wall. Hat channels of 3”-4” width is to be provided for each side of each condensing unit base. Provide flanged feet at all corners of the rack. The rack shall be painted by Foodservice Equipment Contractor. Paint shall be epoxy based and shall be applied over a primer approved for use with such paint in accordance with the manufacturer’s instructions. Paint shall be equal to or better than Sherwin-Williams System 4000 Tile-Clad II (registered TM) catalyzed epoxy coating. Color is to be Slate Gray, unless otherwise specified by the Architect. F.E.C. must validate color with Architect in writing. Provide minimum 18” clearance at the rear of the rack and between the individual condensing units. Coordinate the design with the capability to remove the condensing unit cover for maintenance.

2.27. ITEM SPECIFICATIONS

O.F.O.I. – Owner Furnished, Owner Installed
V.F.V.I. – Vendor Furnished, Vendor Installed
N.I.F.E.C. – Not in Foodservice Equipment Contract.

ITEM #1 HOT SERVING COUNTER

Quantity: One (1)

Manufacturer: Randell
Model: RAN HTD-4

Features:

1. Provide 120V 1PH 16.67A with plug for unit.
2. Top, 14 gauge stainless steel 60" unit.
3. 6" swivel casters (2 locking), standard.
4. Provide (4) hot wells measuring 12" x 20".
5. Provide flexible hose with two-way disconnect for draining hot wells.
6. Provide enclosed cabinet base.
7. Stainless steel construction; provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
8. Provide one (1) 12" deep solid folding V style tray slide on back.
9. Provide breath guard with stainless steel #4 finish uprights and top mounted hardware. Provide slim LED light. Breath guard must meet all NSF standards upon installation.
10. Provide 120V 2A for breath protection.
11. LED light and hot wells to be wired to single point connection.
12. Provide latch assembly.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.
BREATH GUARD ACCEPTABLE MANUFACTURER: BSI, PMG, Versa-Gard

ITEM #1.1 BREATH PROTECTION -- Provided as part of Item 1.

ITEM #1.2 TRAY SLIDE – Provided as part of Item 1.

ITEM #2 SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RAN ST-2

Features:

1. Top, 14 gauge stainless steel 24" unit.
2. Provide enclosed base.
3. 6" swivel casters (2 locking), heavy duty.
4. Stainless steel construction provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
5. Provide one (1) 12" deep solid folding V style tray slide on back.
6. Provide latch assembly.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.

ITEM #2.1 TRAY SLIDE – Provided as part of Item 2.

ITEM #3 TRAY RACK DISPENSER

Quantity: One (1)
Manufacturer: Atlas Metal
Model: MCT-1216

Features:

1. Tray platform, 14 gauge stainless steel.
2. Self-leveling cantilevered platform, 14 gauge stainless steel.
3. Provide vinyl corner bumpers.
4. Provide 4” swivel casters (2 locking), heavy duty.

ACCEPTABLE MANUFACTURER: IMC Teddy, Piper Products

ITEM #8 TRAY RACK DISPENSER

Quantity: One (1)
Manufacturer: Atlas Metal
Model: MCT-1216

Features:

1. Tray platform, 14 gauge stainless steel.
2. Self-leveling cantilevered platform, 14 gauge stainless steel.
3. Provide vinyl corner bumpers.
4. Provide 4” swivel casters (2 locking), heavy duty.

ACCEPTABLE MANUFACTURER: IMC Teddy, Piper Products

ITEM #9 HOT SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RAN HTD-4

Features:

1. Provide 120V 1PH 16.67A with plug for unit.
2. Top, 14 gauge stainless steel 60” unit.
3. 6" swivel casters (2 locking), standard.
4. Provide (4) hot wells measuring 12” x 20”.
5. Provide flexible hose with two-way disconnect for draining hot wells.
6. Provide enclosed cabinet base.
7. Stainless steel construction provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
8. Provide one (1) 12” deep solid folding V style tray slide on back.
9. Provide breath guard with stainless steel #4 finish uprights and top mounted hardware. Provide slim LED light. Breath guard must meet all NSF standards upon installation.
10. Provide 120V 2A for breath protection.
11. LED light and hot wells to be wired to single point connection.
12. Provide latch assembly.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.
BREATH GUARD ACCEPTABLE MANUFACTURER: BSI, PMG, Versa-Gard

ITEM #9.1 BREATH PROTECTION -- Provided as part of Item 9.

ITEM #9.2 TRAY SLIDE -- Provided as part of Item 9.

ITEM #10 SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RAN ST-2

Features:

1. Top, 14 gauge stainless steel 24" unit.
2. Provide enclosed base.
3. 6" swivel casters (2 locking), heavy duty.
4. Stainless steel construction provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
5. Provide one (1) 12" deep solid folding V style tray slide on back.
6. Provide latch assembly.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.

ITEM #10.2 TRAY SLIDE – Provided as part of Item 10.

ITEM #11 HOT HOLDING CABINET

Quantity: One (1)
Manufacturer: Cres Cor
Model: H137SUA12D

Features:

1. Provide 120V unit.
2. Right-hand door swing for front door (top & bottom), standard
3. Model 1405 164 Perimeter Bumper, add 2" to OA dimensions, non-marking, gray.
4. Provide twelve (12) sets wire universal angles.
5. Provide interior for 18 x 26 pans.
6. Analog thermometer
7. Provide with lockable casters.

ACCEPTABLE MANUFACTURER: F.W.E., Metro

ITEM #12 COLD SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RS SSC-RCP-4

Features:

1. Top, 14 gauge stainless steel 60" unit.
2. 6" swivel casters (2 locking), standard.
3. Provide mechanically cooled cold well to accommodate 4 pans.
4. Provide 120V with plug for unit and provide 120V 3A for breath protection.
5. Provide enclosed base.
6. Stainless steel construction; provide laminate panels for front, back, and sides. (Wilsonart Landmark-7981 per architect).

7. Provide One (1) 12” deep solid folding V style tray slide on front – provide tray slide at elementary school height.
8. Provide One (1) 12” deep solid folding V style tray slide on rear – provide tray slide at elementary school height.
9. Provide double-sided breath guard with stainless steel #4 finish uprights and top mounted hardware. Provide slim LED light. Breath guard must meet all NSF standards upon installation.
10. Provide latch assembly.
11. Breath Protection light and cold wells to be wired to single point connection.
12. Provide flexible hose with two-way disconnect for draining cold wells.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.
BREATH GUARD ACCEPTABLE MANUFACTURER: BSI, PMG, Versa-Gard

ITEM #12.1 BREATH PROTECTION – Provided as part of Item 12.

ITEM #12.2 TRAY SLIDE– Provided as part of Item 12.

ITEM #13 MILK COOLER

Quantity: One (1)
Manufacturer: Continental Refrigerator
Model: MC5NSSD

Features:

1. Provide 115V 1PH 7.6A with plug for unit.
2. Provide stainless steel 58” unit.
3. Provide lid locking device.
4. Provide 5” swivel casters with front locking brakes.

ACCEPTABLE MANUFACTURER: Duke, LTI Co.

ITEM #15 VENTILATION HOOD

Quantity: Per Drawing
Manufacturer: Captive-Aire
Model: Custom

Features:

1. F.E.C. shall coordinate the structural, architectural, and mechanical needs of this item with the architect, structural engineers and mechanical engineers to make certain that the unit is sized, located-ed and supported correctly.
2. The F.E.C. will supply and physically install this item in compliance with all State, Local and City Building, Fire and Health codes.
3. Verify that all utility requirements and air volumes are properly matched with the ventilation requirements of the equipment located beneath the hood(s). The F.E.C. is cautioned to avoid sizing the hood and air volumes at design minimums.
4. Shape and locate hood as shown on plan – unless the code and performance needs compel a de-sign change. Any design change must be coordinated and approved by Architect and the mechanical engineers, prior to fabrication.

5. If multiple section hoods must be provided with seams or joints for structural integrity, they must not be located over cooking equipment, and must have a cut-out to allow the hood to act as one system.
6. Construction of hood shall meet or exceed all NFPA-96 requirements.
7. Construct all exterior surfaces of exhaust canopy(s) of 18-gauge type 304 430 stainless-steel. Hood shall be sized to operate without the use of end panels.
8. Interior of hood shall be constructed of 18-gauge 304 430 stainless-steel.
9. Heli-arc weld, grind and polish all seams and joints to blend with the base metal unless the design Listing dictates some other material requirement. Weld metals are to be of same composition as base metal.
10. Caulk hood to wall to seal all gaps. Caulk may not be used to seal joints larger than 1/8".
11. Provide with stainless-steel Captrate Solo Filters, UL listed and easily removable for cleaning with-out the use of tools.
12. Provide system with, but not limited to, the following: ventilator hood(s), duct collars and slide gate balancing dampers (at each exhaust duct collar location only). Exhaust collar balancing damper shall close off no more than 1/3rd of the exhaust collar area. Any additional dampers needed for balancing the exhaust air flow are to be furnished and installed by the mechanical contractor, as a part of this project.
13. Provide stand-offs on all sides to allow 0" clearance to combustibles. A 3" non-insulated stand-off is to be included at the rear of the hood. Stand-offs on the sides are to be 1" insulated sections when against walls and 3" non-insulated sections when not adjacent to a wall. When glass panels are to be provided, 3" non-insulated sections are to be provided. Provide a 1" insulated section on the front of the hood.
14. Any walls behind hood(s) must be constructed of non-combustible materials (e.g. tile backer board, cement board). At the beginning of the project, contact the Architect to verify that wall behind or surrounding the hood(s) is non-combustible.
15. F.E.C. to provide and install type 304 430, 18-gauge stainless-steel wall panels under entire length and ends of the hood(s).
16. F.E.C. to furnish and provide type 304 430, 18-gauge stainless steel closure panels from top of hood to ceiling. Field verify ceiling height.
17. Provide hoods with recessed LED lights, providing sufficient lighting levels to meet code.
18. Provide hoods with structural hanging brackets; factory welded.
19. Provide utility cabinet at one or both ends as required to hold the fire suppression and controls systems.
20. Mount bottom of hood 78" A.F.F. or 80" A.F.F. where ADA clearances are required.
21. Provide a multi-section, 18-gauge stainless-steel horizontal linear utility enclosure. This removable stainless-steel enclosure is to cover the top and front of utilities rough-in along the wall. Design the enclosure to fully cover any horizontal gas, water or electrical services and provide closure to the gap between the back of the equipment and the wall. Minimize the depth required for this utility cover.
22. F.E.C. is to provide all necessary threaded rods, brackets and all hardware required to hang hood where shown.
23. Closely coordinate location of J-boxes for control wiring and lighting with other contractors so that all J-boxes are accessible after the project construction is complete.
24. Fans, starters, curbs, duct, duct insulation, fire rating of duct, and disconnects to be furnished by others and installed by others.
25. F.E.C. to provide Demand Control Ventilation (DCV) system. System to include, but is not limited to: microprocessor or PLC based controller; remote Human-Machine Interface (HMI) panel(s); remote fan override and light controls; input sensors located in the hood capture zone, col-lar, and/or duct; room temperature sensor; BMS communications via BACnet MSTP/IP, Mod-Bus, or LonWorks; and Variable Frequency Drives (VFD), if not provided by others. Remote HMI panels to include visual status display and can include fan override and light controls. In-put sensor types are to be temperature, optical, pressure, and/or infrared and can include additional room sensors, as necessary. FEC to verify BMS protocol with HVAC/Controls Engineer. Proprietary BMS protocol is allowed only if compatibility is first verified with the HVAC/Controls

Engineer. FEC to provide and install all hardware and software of any approved proprietary system.

26. F.E.C. to coordinate location of control boxes. Installation of remote HMI panels to ensure that they are flush with mounting surfaces. DCV controller to be mounted in cabinet at the end of the hood.
27. Any and all conduit exposed to view shall be chrome plated or stainless steel. This requirement includes all cover plates, fixtures, elbows, et cetera.
28. Ductwork is furnished, installed, and fire rated by other Contractors. - N.I.F.E.C.
29. Ventilator fan is furnished and installed by other Contractors - N.I.F.E.C.
30. Curb(s) and equipment rails shall be furnished and installed by other Contractors - N.I.F.E.C.
31. Hood and complete ventilation system is to be balanced by other Contractors - N.I.F.E.C.
32. Closely coordinate the needs of this hood ventilator, and all other hood ventilators in this project, to eliminate any concerns or issues related to hood capture, code compliance, duct size, type or location, fan size and any other element that might become a problem for the Owner. Supply hood air requirements to those providing the non-hood portions of the ventilation system. Include static pressure, volume and dimensional information. Submit this in a timely manner. If there are problems related to this hood, F.E.C. agrees to perform velometer tests, as needed, and to pay for the costs associated with any hood problem related issues that arise. If any Architect representatives need to be involved in seeking solutions to performance or capture challenges, the F.E.C. agrees to pay the hourly and travel costs associated with these activities.

ACCEPTABLE MANUFACTURERS: None

ITEM #15.1 VENTILATION HOOD CONTROL BOX – Provided as part of Item 15.

ITEM #15.2 HOOD CONTROL USER INTERFACE – Provided as part of Item 15.

ITEM #16 FIRE SUPPRESSION SYSTEM

Quantity: One (1)
Manufacturer: Ansul Fire Protection
Model: R-102 Wet Agent

Features:

1. Model R-102 WET AGENT Provide a complete automatic fire protection system sized to protect all of hood ITEM 16.
2. The pre-engineered, listed, wet chemical agent system shall be capable of suppressing fires in the areas associated with ventilating equipment including hoods, ducts, plenums, and filters as well as auxiliary grease extraction equipment. The system shall also be capable of suppressing fires in are-as associated with cooking equipment.
3. The basic system shall consist of a regulated release assembly which includes a regulated release mechanism and a stainless steel wet chemical storage tank housed within a single stainless steel enclosure. Nozzles, metal blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station(s), mechanical and electrical gas valve(s), and electrical switches for automatic equipment and gas line shut-off, and building fire alarm control panel interface. Provide all necessary components required for code approved installation.
4. The system shall be capable of automatic actuation by a fusible link or electric thermal detection system and remote manual actuation by a mechanical pull station.
5. F.E.C. to verify with Engineer if a mechanical or electrical based system should be provided. Verify quantity and size of gas valves to be provided. Provide all necessary components of system re-quired.

6. A mechanical system shall consist of, but is not limited to: mechanical regulated release assembly; mechanical fuel shut-off valve(s) to automatically cut-off fuel to the equipment located beneath the hood in the event of fire; fusible link detectors; cable, pulleys and conduit.
7. An electrical system shall consist of, but is not limited to: electrical regulated release assembly; electric fuel shut-off valve(s) to automatically cut-off fuel to the equipment located beneath the hood in the event of fire; electric thermal detectors; wiring and conduit; manual reset relay; and switches.
8. Interconnect system to shunt-trip breaker or switches to cut-off all electrical service to equipment located beneath the hood in the event of fire.
9. Provide with two (2) micro switches for each system. Verify which configuration is required to tie into the building alarm system: normally open or normally closed.
10. Provide certificate of charge and test by a State authorized Ansul dealer 2 weeks prior to final foodservice inspection by Bakergroup.
11. Unit to be installed in conformance with NFPA-96, UL300 and all applicable codes.
12. Fire suppression systems shall not contain ozone depleting substances such as CFC's, HCFC's or Halons.
13. System designed to protect ductwork at collar and equipment under hood, unless otherwise specified.
14. E.C. is to wire micro switch to shut down hood make up air only. Exhaust fan is to remain on to remove smoke or as dictated by local code.
15. Distribution piping shall not be run horizontally within the exposed hood capture area.
16. Any and all distribution piping exposed to view shall be chrome plated or stainless steel. This requirement includes all fixtures, elbows, et cetera.
17. Provide required UL-300 extinguishing nozzles for all grease producing equipment.
18. F.E.C. shall install this system at a time when the walls are accessible unless directed otherwise by C.M. Surface mounted components will not be accepted.
19. Prior to installing system, verify in writing with the architect, the location of agent tanks and pull stations. See Foodservice drawings for location of agent tanks and suggested locations for pull stations.
20. The F.E.C. will install this system to the highest standards, hiding pipe where possible, avoiding random and unnecessary penetrations in hood enclosures, concealing pipe and conduit for pull stations, coordinating the installation of the pull stations to be flush with finished wall surfaces, and running individual feeds to each head (instead of manifolding them together within the hood cavity).
21. Provide any drawings and specifications required to satisfy reviewing authorities. Copies are also to be provided to Bakergroup for review prior. Drawings to include: locations of agent tank cabinet(s) and remote pull station; piping design layout; type, quantity and location of nozzles; type and quantity of gas shut-off valve; type and quantity of detectors; and control diagram indicating available and/or required external connections. Provide in approved electronic format. Provide hard copies, if required.

ACCEPTABLE MANUFACTURERS: None

ITEM #16.1 FIRE SUPPRESSION PULL STATION –Provided as part of Item 16.

ITEM #17 INDUCTION RANGE

Quantity: One (1)
Manufacturer: Southbend
Model: P36C-ISI

Features:

1. Provide (4) 12” induction cook tops, separated by 12” stainless steel spreader, 36” unit.
2. Provide 208V, 3PH, 34.0A

3. Provide stainless steel cabinet base with doors.
4. Provide 9- ¼” deep front rail.
5. Provide removable drip tray.

ACCEPTABLE MANUFACTURER: Garland

ITEM #18 FILLER FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0598

Features:

1. Provide Double joint swing nozzle.
2. Provide wall mounted 8” centers.
3. Provide Handle at end of faucet for easy accessibility to turn on and off.

ACCEPTABLE MANUFACTURER: None

ITEM #19 CONVECTION STEAMER

Quantity: One (1)
Manufacturer: Cleveland Range
Model: (2) 22CET66.1

Features:

1. Provide (2) electric boilerless convection steamers, with water reservoir, automatic fill controls, stacked.
2. Electric: provide (2) 208V, 3PH, 29.8A, 3-wire.
3. Provide stainless steel equipment stand.
4. Provide removable stainless steel racks.
5. Provide cold water condenser for each compartment.
6. Steam chamber to be all stainless steel construction.
7. Door hinge on left per plan.
8. Provide temperature probe.
9. Provide cartridge based Everpure, Cuno or equal water filtration system, properly matched to the manufacturers filter requirements for this unit and local water conditions. Test local water conditions prior to ordering unit. Mount out of customer view, yet accessible for maintenance, and in a location, that will not expose the unit to damage from cart traffic.
10. F.E.C. shall provide chrome vacuum breaker, chrome backflow preventer or other equipment-specific hardware as required by local health department.

ACCEPTABLE MANUFACTURER: Groen

ITEM #19.1 WATER FILTRATION -- Provide as part of Item 19.

ITEM #20 CONVECTION OVEN

Quantity: One (1)
Manufacturer: Blodgett
Model: MARK V-100 BBL

Features:

1. Electric: provide (2) 208V, 3PH, 53A, stacked.
2. Factory start-up and verification of meeting operating performance requirements.
3. Fully welded stainless steel frame.
4. Stainless steel top, front, sides and back.
5. Annealed stainless steel finish in cooking chambers.
6. (7) Stainless steel wire shelves, per section.
7. Double paned glass doors.
8. Provide extra oven rack.
9. Provide stainless steel drip pans.
10. Interior lights.
11. Provide 4” casters; two (2) locking.

ACCEPTABLE MANUFACTURER: None

ITEM #23 PASS-THRU REFRIGERATOR

Quantity: One (1)
Manufacturer: Continental Refrigerator
Model: 1RENSSPT

Features:

1. 5" Casters, lockable
2. Stainless steel interior and exterior.
3. Exterior thermostats.
4. Provide lockable pass thru doors hinged as shown on plan
5. Provide epoxy coated shelves.

ACCEPTABLE MANUFACTURER: True, Traulsen, Victory

ITEM #24 REACH-IN FREEZER

Quantity: One (1)
Manufacturer: Continental Refrigerator
Model: 2FSNSS

Features:

1. Left Door hinged on left & right door hinged on right, standard
2. Model 50177-4 Casters, swivel, with brakes (5" diameter rubber tires) set of 4 (6" height)
3. Stainless steel interior and exterior.
4. Provide top mounted condensing unit.
5. Exterior thermostats.
6. Provide lockable doors hinged as shown on plan
7. Provide epoxy coated shelves.

ACCEPTABLE MANUFACTURER: True, Traulsen, Victory

ITEM #25 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group

Model: HSA-10-FA-1P

Features:

1. All stainless steel construction – all welded.
2. Provide faucet with foot pedals.
3. Provide drain and P-Trap.
4. Provide all necessary mounting hardware.
5. Owner to provide each sink with a soap, glove dispenser and towel dispenser.
6. Provide with front perimeter enclosure.
7. Must meet all ASSE 1070 requirements.
8. Provide 6” stainless steel splashguards.

ACCEPTABLE MANUFACTURER: Advance Tabco, Krowne

ITEM #26 TRASH CAN -- O.F.O.I.

ITEM #27 STORAGE RACK

Quantity: Per Drawing
Manufacturer: Metro
Model: MetroMax 4 – Sized per drawing

Features:

1. 86" post with antimicrobial protection, size per plan.
2. Lockable casters.
3. 15-year warranty against corrosion.
4. Removable polymer shelf mats.
5. Adjustable shelves with antimicrobial protection.
6. Assemble and install racks, making certain that rack shelving does not interfere with door swings, lighting, drains, or any other equipment.
7. Provide 5 shelves.

ACCEPTABLE MANUFACTURER: Eagle Group, Cambro

ITEM #30 PAN RACK

Quantity: One (1)
Manufacturer: Cres Cor
Model: 2071820

Features:

1. Utility rack.
2. Provide 5” casters (2 lockable).
3. Provide open sides.
4. Accommodates (20) 18” x 36” sheet pans, slides on 3” centers.
5. Provide welded aluminum construction.

ACCEPTABLE MANUFACTURERS: Cambro, Advance Tabco, New Age, Metro

ITEM #31 PAN RACK

Quantity: One (1)
Manufacturer: Cres Cor

Model: 2071820

Features:

1. Utility rack.
2. Provide 5” casters (2 lockable).
3. Provide open sides.
4. Accommodates (20) 18” x 36” sheet pans, slides on 3” centers.
5. Provide welded aluminum construction.

ACCEPTABLE MANUFACTURERS: Cambro, Advance Tabco, New Age, Metro

ITEM #32 BREAD RACK – V.F.V.I

ITEM #33 BREAD RACK – V.F.V.I

ITEM #40 WORK TABLE WITH SINKS AND DRAWERS

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

Features:

1. Model CUSTOM Size and shape per plan
2. Construct per details and General Standards.
3. Construct entirely of stainless steel; top shall be 14 gauge.
4. Provide sound deadening per General Standards.
5. Stainless steel 1-5/8" diameter legs, leg gussets and adjustable flanged feet
6. Provide 6” backsplash, enclosed on all sides
7. Must be NSF Approved Fabricator
8. Provide sink(s) per plan and General Standards; sink(s) shall be 14 gauge and have coved corners.
9. Provide faucet per general specs to match the size sink in the details. Faucet shall be B-0221-CR-K-F10 (Include B-0199-01-F10 1.0 GPM Aera-tor) or approved other.
10. Drains that are a part of the worktable or the equipment mounted into the worktable shall be pre-plumbed. Plumbing shall not be less than ¾” in diameter. All plumbing lines shall be installed to minimize interference with the useful function of the worktable cavity. Wherever possible, plumbing lines shall be run against rear surfaces and undersides of equipment and/or shelving to minimize this interference.
11. Wherever penetrations must be made in the worktable to accommodate the passage of utilities, refuse drop holes or other needs, fully sleeve these penetrations so that liquids are prevented from running into the penetration.
12. Provide 3-tier stainless-steel locking utensil drawers, one location. Construct per General Standards. In addition, provide stainless-steel double pan constructed drawer fronts, removable stain-less-steel drawer liners, full extension slides and stainless-steel exterior housing. Provided keyed alike drawers to items 50 and 54.
13. All final power connections to be by E.C. Worktables shall arrive pre-wired by the Fabricator to meet all but not limited to local and state standards. All worktable wiring will meet or exceed prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.
14. Where J-boxes or receptacles are to be installed within the worktable, fabricator shall provide appropriate mounting plates or other structure for same. Fabricator to provide and install all

boxes, conduit and devices required. E.C. to provide and install all wire from fabricator pre-wired devices to points of final connection.

15. Electrical and plumbing work shall be performed to the highest standards and shall meet with all applicable codes.
16. All wiring will meet or exceed prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.
17. Switches, receptacles, and other electric appliances that are built into the worktable shall be pre-wired by the F.E.C. to an accessible and convenient connection point, consistent with the electrical requirements shown on the project documents. Provide pre-wired per all NEC codes.

ACCEPTABLE MANUFACTURER: Advance Tabco, Eagle

ITEM #40.1 FAUCET – Provided as part of Item 40.

ITEM #41 OVERSHELF

Quantity: Two (2)
Manufacturer: Advance Tabco
Model: 15” deep; length as shown on plan

Features:

1. 16 gauge stainless steel solid shelf.
2. Provide all hardware and properly mount at height determined by owner.

ACCEPTABLE MANUFACTURER: Eagle, Approved Fabricator

ITEM #43 CAN OPENER

Quantity: One (1)
Manufacturer: Edlund
Model: S-11

Features:

1. Model S-11 Can Opener, manual, 16" bar length, dishwasher safe, rust proof, stainless steel, with cast stainless steel base, NSF certified
2. Stainless steel with cast stainless steel base.
3. Provide with ST-93 Rustproof can opener cleaning tool.

ACCEPTABLE MANUFACTURER: None

ITEM #45 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSA-10-FA-1P

Features:

1. All stainless steel construction – all welded.
2. Provide faucet with foot pedals.
3. Provide drain and P-Trap.
4. Provide all necessary mounting hardware.
5. Owner to provide each sink with a soap, glove dispenser and towel dispenser.

6. Provide with front perimeter enclosure.
7. Must meet all ASSE 1070 requirements.
8. Provide 6” stainless steel splashguards.

ACCEPTABLE MANUFACTURER: Advance Tabco, Krowne

ITEM #46 REACH-IN REFRIGERATOR

Quantity: One (1)
Manufacturer: Continental Refrigerator
Model: 2RNSS

Features:

1. Stainless steel interior and exterior.
2. Provide top mounted condensing unit.
3. Electric: 115V, 1PH, 6.9A with plug.
4. Provide LED interior lights.
5. Provide lockable solid doors with left door hinged on left & right door hinged on right.
6. Provide epoxy coated shelves.
7. Provide 5" Casters with locks.

ACCEPTABLE MANUFACTURER: True, Traulsen, Victory

ITEM #47 DESK – N.I.F.E.C.

ITEM #50 WORKTABLE WITH DRAWERS AND OVERSHELF

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

1. Model CUSTOM Size and shape per plan
2. Construct per details and General Standards. Construct entirely of stainless steel; top shall be 14 gauge.
3. Provide sound deadening per General Standards.
4. Stainless steel 1-5/8" diameter legs, leg gussets and adjustable flanged feet
5. Must be NSF Approved Fabricator
6. Provide 3-tier stainless-steel locking utensil drawers. Construct per General Standards. In addition, provide stainless-steel double pan constructed drawer fronts, removable stain-less-steel drawer liners, full extension slides and stainless-steel exterior housing. Provided keyed alike drawers to items 40 and 54.
7. Provide 16-gauge stainless-steel counter mounted, double over shelf per details. Provide with all necessary hardware to properly sit shelf where shown. Verify location in writing with owner before hanging.
8. Wherever penetrations must be made in the worktable to accommodate the passage of utilities, refuse drop holes or other needs, fully sleeve these penetrations so that liquids are prevented from running into the penetration.
9. Provide 3-tier stainless-steel locking utensil drawers, one location. Construct per General Standards. In addition, provide stainless-steel double pan constructed drawer fronts, removable stain-less-steel drawer liners, full extension slides and stainless-steel exterior housing. Provided keyed alike drawers.
10. All final power connections to be by E.C. Worktables shall arrive pre-wired by the Fabricator to meet all but not limited to local and state standards. All worktable wiring will meet or exceed

prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.

11. Where J-boxes or receptacles are to be installed within the worktable, fabricator shall provide appropriate mounting plates or other structure for same. Fabricator to provide and install all boxes, conduit and devices required. E.C. to provide and install all wire from fabricator pre-wired devices to points of final connection.
12. Electrical and plumbing work shall be performed to the highest standards and shall meet with all applicable codes.
13. All wiring will meet or exceed prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.
14. Switches, receptacles and other electric appliances that are built into the worktable shall be pre-wired by the F.E.C. to an accessible and convenient connection point, consistent with the electrical requirements shown on the project documents. Provide pre-wired per all NEC codes.

ACCEPTABLE MANUFACTURER: Advance Tabco, Eagle

ITEM #52 TRASH BIN -- O.F.O.I

ITEM #53 COMPOSTING BIN -- O.F.O.I.

ITEM #54 WORKTABLE WITH DRAWERS AND OVERSHELF

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

1. Model CUSTOM Size and shape per plan
2. Construct per details and General Standards. Construct entirely of stainless steel; top shall be 14 gauge.
3. Provide sound deadening per General Standards.
4. Stainless steel 1-5/8" diameter legs, leg gussets and adjustable flanged feet
5. Must be NSF Approved Fabricator
6. Provide 16-gauge stainless-steel counter mounted, double over shelf per details. Provide with all necessary hardware to properly sit shelf where shown. Verify location in writing with owner before hanging.
7. Wherever penetrations must be made in the worktable to accommodate the passage of utilities, refuse drop holes or other needs, fully sleeve these penetrations so that liquids are prevented from running into the penetration.
8. Provide 3-tier stainless-steel locking utensil drawers, one location. Construct per General Standards. In addition, provide stainless-steel double pan constructed drawer fronts, removable stainless-steel drawer liners, full extension slides and stainless-steel exterior housing. Provided keyed alike drawers.
9. All final power connections to be by E.C. Worktables shall arrive pre-wired by the Fabricator to meet all but not limited to local and state standards. All worktable wiring will meet or exceed prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.
10. Where J-boxes or receptacles are to be installed within the worktable, fabricator shall provide appropriate mounting plates or other structure for same. Fabricator to provide and install all boxes, conduit and devices required. E.C. to provide and install all wire from fabricator pre-wired devices to points of final connection.
11. Electrical and plumbing work shall be performed to the highest standards and shall meet with all applicable codes.

12. All wiring will meet or exceed prevailing codes for the work category. Run all electrical wiring in moisture resistant, armored conduit, out of sightlines and workspaces.
13. Switches, receptacles and other electric appliances that are built into the worktable shall be pre-wired by the F.E.C. to an accessible and convenient connection point, consistent with the electrical requirements shown on the project documents. Provide pre-wired per all NEC codes.

ACCEPTABLE MANUFACTURER: Advance Tabco, Eagle

ITEM #59 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSA-10-FA-1P

Features:

1. All stainless steel construction – all welded.
2. Provide faucet with foot pedals.
3. Provide drain and P-Trap.
4. Provide all necessary mounting hardware.
5. Owner to provide each sink with a soap, glove dispenser and towel dispenser.
6. Provide with front perimeter enclosure.
7. Must meet all ASSE 1070 requirements.
8. Provide 6” stainless steel splashguards.

ACCEPTABLE MANUFACTURER: Advance Tabco, Krowne

ITEM #60 UTILITY CART

Quantity: One (1)
Manufacturer: Lakeside Manufacturing
Model: 710

Features:

1. All-welded stainless steel construction, 700lb capacity.
2. Provide (2) shelves.
3. Provide (2) 5” swivel and (2) 8” fixed casters.

ACCEPTABLE MANUFACTURER: Carlisle

ITEM #61 SAFETY CABINET

Quantity: One (1)
Manufacturer: Global Industrial
Model: 298541

Features:

1. Model 298541 Flammable Liquid Cabinet, 43"W x 18"D x 65"H, 45 gallon capacity, (2) adjustable shelves, (2) manual close hinged doors, steel construction with powder coat finish (NET)
2. Steel construction with powder coat cabinet.
3. Provide (2) adjustable shelves.
4. Provide (2) manual close hinged doors.

ACCEPTABLE MANUFACTURER: None

ITEM #62 UTILITY CART

Quantity: One (1)
Manufacturer: Lakeside Manufacturing
Model: 710

Features:

1. All-welded stainless steel construction, 700lb capacity.
2. Provide (2) shelves.
3. Provide (2) 5” swivel and (2) 8” fixed casters.

ACCEPTABLE MANUFACTURER: Carlisle

ITEM #63 CUSTOM MILLWORK - SCRAPPING STATION

MANUFACTURER: Approved Fabricator

QUANTITY: One (1)

MODEL: Custom Fabricated

FEATURES:

1. Unit to be shaped, sized and located where shown on plan. Construct per drawing details, the requirements of the General Standards and this specification.
2. Counter to be constructed to support all equipment, materials, utilities, and products without deflection at any point. In addition, the unit shall be able to support 300 pounds of live weight at any point without deflection.
3. Counter shall be constructed as a rigid structure, suitable for use in a foodservice facility of this type. Countertop edge profile per details.
4. Support on stainless steel adjustable legs, with appropriate base materials attached as shown on details.
5. Unless otherwise illustrated in the detailed drawings, provide 2" high end or backsplashes wherever the counter meets an adjacent walls or other fixed equipment.
6. Where end or backsplashes are employed, seal counter to wall with silicone caulk, taking care to tape seams before applying caulk. Sealing gaps greater than 1/8" will not be acceptable. If the contractor fails to tape the joint and there is caulk residue on the adjacent surface, the contractor will completely remove the caulk, restore the adjacent surface if damaged, tape and reapply the caulk in an improved manner.
7. Wherever penetrations must be made in the counter to accommodate the passage of utilities, refuse drop holes or other needs, fully sleeve these penetrations so that liquids are prevented from running into the penetration.
8. Interior of the counter shall be constructed to provide storage and service access for the equipment shown on plan. Where the counter cavity is not serving as housing for the counter-based equipment, the remaining space shall be developed as a storage cavity. Each storage cavity shall be provided with cleanable back, bottom and sides, rising from the floor of the cabinet to a height of 12” above the floor. The balance of the cavity should be constructed with a melamine finish. Provide trim strips and other finish materials to allow counter-based equipment to be removed for service, when necessary.
9. Due to variations in construction methods between fabricators, drawing details for counters may not show all of the structural support, mounting methods and utility chases required. The counter(s) must be fabricated to meet the performance needs of the plan, and these specifications (e.g. support the beverage and ice machine without deflection, meet NSF standards, et cetera). The exterior elevations and sections do accurately indicate the exterior needs of the counter including materials, dimensions and shape.

10. The location of counter seams, laminate seams and other visible breaks must be approved by the Architect and Bakergroup. Minimize the visibility of these joints. Surfacing material seams and joints shall be designed to occur where counter angles change. Where there is a need to provide multiple sections along a straight counter, the fabricator will design the seams or surface joints to be evenly spaced across the length of the unit. No seams shall go through any heated equipment such as drop in hot wells or heated shelves.
11. Wherever mobile equipment is to be parked up against any counter, provide and install rigid stainless steel angles along the floor to prevent the parked equipment from bumping into the counter. In addition, provide a trimmed out stainless steel protective surface around the interior of counter cutouts where equipment such as lowerators are to be parked.
12. Provide for all counter doors: Three (3) Rockford Process Control (RPC) Five Knuckle Hinge in 304 stainless steel. NOTE: Where the weight of the hinged mass exceeds the support limits of the hinge, provide acceptable manufacturer hinge options for consideration by Bakergroup. Provide in all locations of doors Hafele Item No. 115.61.601: Wire Handle, Matt, Stainless Steel; grade 304, 96 CTC, 106 mm length.
13. Hinge mounts must be strong enough to prevent the hinges from pulling out of the substrate. Doors, hinges and latches shall be designed for long-term durability and have a 10-year warrantee against failure. Mount hinges per Bakergroup detail, rigidly securing the hinge to the door, using five stainless steel flathead screws for each hinge. Rigidly mount hinges to casework using two ¼" bolts similarly secured with hex flange locknuts with nylon inserts and two 3/16" flathead screws for each hinge. Door Catches: Shall be adjustable heavy duty Amerock Roller Catch BP98232G, Amerock Double Roller Catch Part No. 143 or approved equal. Provide non-magnetic type.
14. All surfaces shall be free of burrs and rough edges.
15. Mounting screws and bolts shall match the material they are securing (e.g. stainless screws to attach stainless metal banding, et cetera).
16. Follow all material and appliance manufacturer's requirements for the handling, fabrication, and installation of these items. If any material is deemed unsuitable for the intended use, the F.E.C. must note this in their bid.
17. Provide stainless steel "L" shaped stopper brackets securely mounted to the ground for any equipment on casters built in counter or counter is cut out around. Stopper brackets purpose to hinder equipment from causing destruction of counter.

ITEM #64 TRASH BIN -- O.F.O.I.

ITEM #65 RECYCLING BIN -- O.F.O.I.

ITEM #66 COMPOSTING BIN - O.F.O.I.

ITEM #67 EYE WASH STATION

Quantity: One (1)
Manufacturer: T&S Brass
Model: EW-7656WC

Features:

1. Wall mounted, recessed eyewash unit.
2. Stainless steel housing.

ACCEPTABLE MANUFACTURER: None

ITEM #68 TRASH BIN -- O.F.O.I.

ITEM #69 COMPOSTING BIN -- O.F.O.I.

ITEM #70 SOILED DISHTABLE

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

Features:

1. Size and shape per plan.
2. Construct per details and General Standard. Construct entirely of stainless-steel; top and sink bowls shall be 14 gauge, 3” rolled rim along all outside edges, 1-5/8" diameter legs and stainless-steel cross rails per General Standard.
3. Sinks shall slope to drains with coved corners.
4. Dish table should slope to drains so that no water pools.
5. Apply sound deadening per General Standard.
6. Provide backsplash (refer to details for height) and sloping back to wall 2" at a 45 degree angle and turned-down ½" toward floor, with enclosed ends. Fasten to wall with Z-clips and seal with silicone caulk.
7. Stainless-steel adjustable feet and leg gussets
8. Provide rotary wastes with connected chrome tailpiece and overflow. Provide stainless-steel mounting clip for each rotary waste valve.
9. Provide removable under-shelving. Provide with closed end-splashes, if exposed.
   Provide 18 gauge stainless-steel wall panel on wall for the entire length of dishtable, to a height 24" above backsplash. Wall paneling shall be joined together with t-strips and sealed with silicone caulk.
10. Top of lip to be 34” above finished floor.
11. Provide with (2) pre-rinse from T&S Brass B-0133-12CRBJST, wall mounted.
12. Provide stainless steel disposer cone for item 72.
13. Construct table to exactly match dishmachine manufacturer’s requirements and all adjacent equipment/tables.
14. Provide with pre-rinse sink before entry to dishmachine to meet code.

ACCEPTABLE MANUFACTURER: Advance Tabco

ITEM #70.1 PRE-RINSE FAUCET – Provided as part of item 70.

ITEM #70.2 SANITIZER – N.I.F.E.C.

ITEM #70.3 PRE-RINSE FAUCET – Provided as part of item 70.

ITEM #72 DISPOSER

Quantity: One (1)
Manufacturer: Salvajor
Model: 300-CA-18-ARSS-LD

Features:

1. Provide 208V, 3PH, 8.8A electrical.
2. Provide with all components necessary for complete installation including, but not limited to, vacuum breaker, solenoid valve, water flow control and water inlets.
3. Provide chrome plated vacuum breaker, chrome plated piping and 45° slip flanges mounted into backsplash.
4. Provide stainless steel water tight control panel with disconnect, start/stop buttons and automatic reversing.
5. Provide all components necessary for mounting into cone sink, provided and welded to be integral to the table surface.
6. Provide swirl spray valves (2) mounted in cone and designed to regulate water flow.
7. Provide sprayer so that it cannot extend below the flood level rim of sink
8. Adjust water feed so that unit operates properly, but does not discharge food or water through the top of the disposer opening.
9. F.E.C. shall provide a reduced pressure zone backflow preventer mounted anywhere in-line or, as required by the local Health Department regulations, provide pressure-style vacuum breaker or other accessories, to the M.C. for installation by same for each water connection

ACCEPTABLE MANUFACTURER: Insinkerator

ITEM #75 OVERSHELF

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 15” deep; length as shown on plan

Features:

1. 16 gauge stainless steel solid shelf
2. Provide all hardware and properly mount at height determined by owner.

ACCEPTABLE MANUFACTURERS: Eagle, Approved Fabricator

ITEM #76 OVERSHELF

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 15” deep; length as shown on plan

Features:

3. 16 gauge stainless steel solid shelf
4. Provide all hardware and properly mount at height determined by owner.

ACCEPTABLE MANUFACTURERS: Eagle, Approved Fabricator

ITEM #77 DISH MACHINE

Quantity: One (1)
Manufacturer: Hobart
Model: CL44EN-ADV+BUILDUP

Features:

1. Conveyor Dishwasher, Advansys model, single tank, (202) racks/hour, insulated hinged doors, .62 gallon/rack, stainless steel enclosure panels, microprocessor controls with low temperature & dirty water indicators, NSF Pot & Pan mode, programable de-lime notification, 30 kW stainless booster, energy recovery (DWER), automatic soil removal (ASR), drain water tempering kit, ENERGY STAR®
2. Electric tank heat 15kW
3. 30kW electric booster
4. 480V, 3PH
5. Single Point (1) service connection standard
6. Standard height
7. Right to left operation
8. Standard feet.
9. NOTE: For water of 3-grains of hardness or more, Hobart suggests adding a water softener.
10. 21” Adjustable vent stack extension, field installed.
11. Include Blower Dryer, Electric, R-L (BDERLCD-STDDOM); standard height

ACCEPTABLE MANUFACTURER: Champion

ITEM #77.1 BLOWER DRYER - Provided as part of item 77.

ITEM #80 CLEAN DISHTABLE

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

Features:

1. Clean dish table, straight design.
2. Right to left operation.
3. Size and shape as per plan.
4. Provide 14 gauge/304 stainless steel top.
5. Provide 16 gauge/304 stainless steel legs and cross bracing.
6. Provide backsplash. Refer to details for height.
7. Provide 3” rolled front and side rims.
8. Sound deadening per General Standards.

ACCEPTABLE MANUFACTURERS: Advance Tabco, Eagle

ITEM #81 OVERSHELF

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 15” deep; length as shown on plan

Features:

5. 16 gauge stainless steel solid shelf
6. Provide all hardware and properly mount at height determined by owner.

ACCEPTABLE MANUFACTURERS: Eagle, Approved Fabricator

ITEM #84 FLOOR TROUGH

Quantity: One (1)
Manufacturer: Advance Tabco
Model: FFTG-1272

Features:

1. ADA compliant
2. Size and shape per plan
3. Pultruded Fiberglass Grating
4. Meets class 1 rating of 25 or less per ASTM E-84.
5. Meets requirements of ASTM D-635.
6. Resin UV inhibited
7. 0.4” spacing for ADA
8. Panels with permanently bonded grit, baked epoxy, anti-skid surface
9. Grating to carry uniform distributed load of 200 pounds. per sq. ft. on span up to 36” and not to deflect more than 0.25”.
10. Bearing Bars to provide minimum 1” wide openings.
11. Provide Safing for trough.
12. Grating shall run in one direction; away from equipment.
13. Include 14-gauge stainless-steel pans/trough per drawing details.

ACCEPTABLE MANUFACTURER: Eagle

ITEM #85 THREE COMPARTMENT SINK

Quantity: One (1)
Manufacturer: Approved Fabricator
Model: CUSTOM

Features:

1. Model CUSTOM Size and shape per plan and details
2. Construct per details and General Standards.
3. Construct entirely of stainless-steel; top and sink bowls shall be 14-gauge, 2-1/2” rolled rim along all outside edges, 1-5/8" diameter legs and stain-less-steel cross rails per General Standards.
4. Sink shall slope to drains with coved corners.
5. Provide sound deadening per General Standards.
6. Provide backsplash rising 8", minimum, and sloping back to wall 2" at a 45-degree angle and turned-down ½" toward floor, with enclosed ends. Fasten to wall with Z-clips and seal with silicone caulk.
7. Stainless-steel adjustable feet and leg gussets
8. Potsink shall have all welded drain boards. Drain boards and sink must slope to drain so that no water pools on work surfaces.
9. There shall be a 2" air gap between sinks. Provide front apron in front of sink bowls.
10. Provide swing nozzles as shown on details.
11. Provide two (2) T&S B-0230-CR-SC-EK wall mounted, 18" swivel nozzle faucets.
12. Provide one (1) pre-rinse faucet T&S B-0100-12CRBJST, wall mounted with add on faucet 12” swivel nozzle.
13. Provide stainless steel disposer cone for item 86.
14. Provide rotary wastes with connected chrome tailpiece and overflow. Provide stainless-steel mounting clip for each rotary waste valve.
15. Provide removable undershelving. Provide with closed endsplashes, if exposed.

16. Provide 18-gauge stainless-steel wall panel on wall for the entire length of pot sink, to a height of 24" above backsplash. Wall paneling shall be joined together with t-strips and sealed with silicone caulk.
17. Top of potsink lip to be 36” above finished floor.
18. Provide rear connected overflows.

ACCEPTABLE MANUFACTURERS: Advance Tabco, Eagle

ITEM #85.1 PRE-RINSE FAUCET – Provided as part of Item 85.

ITEM #85.2 FAUCET – Provided as part of Item 85.

ITEM #85.3 FAUCET – Provided as part of Item 85.

ITEM #85.4 SANITIZER – N.I.F.E.C.

ITEM #86 DISPOSER

Quantity: One (1)
Manufacturer: Salvajor
Model: 300-CA-18-ARSS-LD

Features:

1. Provide 208V, 3PH, 8.8A electrical.
2. Provide with all components necessary for complete installation including, but not limited to, vacuum breaker, solenoid valve, water flow control and water inlets.
3. Provide chrome plated vacuum breaker, chrome plated piping and 45° slip flanges mounted into backsplash.
4. Provide stainless steel water tight control panel with disconnect, start/stop buttons and automatic reversing.
5. Provide all components necessary for mounting into cone sink, provided and welded to be integral to the table surface.
6. Provide swirl spray valves (2) mounted in cone and designed to regulate water flow.
7. Provide sprayer so that it cannot extend below the flood level rim of sink
8. Adjust water feed so that unit operates properly, but does not discharge food or water through the top of the disposer opening.
9. F.E.C. shall provide a reduced pressure zone backflow preventer mounted anywhere in-line or, as required by the local Health Department regulations, provide pressure-style vacuum breaker or other accessories, to the M.C. for installation by same for each water connection

ACCEPTABLE MANUFACTURER: Insinkerator

ITEM #87 OVERSHELF

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 15” deep; length as shown on plan

Features:

7. 16 gauge stainless steel solid shelf
8. Provide all hardware and properly mount at height determined by owner.

ACCEPTABLE MANUFACTURERS: Eagle, Approved Fabricator

ITEM #88 TRASH BIN -- O.F.O.I.

ITEM #89 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSA-10-FA-1P

Features:

1. All stainless steel construction – all welded.
2. Provide faucet with foot pedals.
3. Provide drain and P-Trap.
4. Provide all necessary mounting hardware.
5. Owner to provide each sink with a soap, glove dispenser and towel dispenser.
6. Provide with front perimeter enclosure.
7. Must meet all ASSE 1070 requirements.
8. Provide 6” stainless steel splashguards.

ACCEPTABLE MANUFACTURER: Advance Tabco, Krowne

ITEM #100 WALK-IN COOLER / FREEZER

Quantity: One (1)
Manufacturer: American Panel Corporation

Features:

1. Model CUSTOM Size and shape per plans and specifications, 8’10” high (in 8.5” pit)
2. Exterior exposed panel surfaces shall be 20 gauge smooth #304 stainless steel. Unexposed exterior panels shall be stucco aluminum.
3. Interior panel surfaces shall be 20 ga stainless steel.
4. Walk-in with 4” thick factory floor (constructed in the same method and materials as wall and ceiling panels) to be set in a minimum 8.5” deep pit plus wearing floor surface by others; interior pre-manufactured floor surface to be galvanized finish. Concrete by others. See typical detail. Provide s/s coved base for interior of walk-in.
5. Provide 16 gauge stainless steel coved base on exterior of walk-in where finished panels are located.
6. Provide 4” clearance above walk-ins for installation of walk-in.
7. Remove all manufacturers’ stickers, plates, etc on exterior of walk-in. Exterior of walk-in shall be free of all manufacturer branding. Plates or manufacturer named stickers may be added in interior of walk-in only. These shall not be visible to customers if viewing windows are present.
8. Trim and C/J closure panels shall be 20 gauge smooth #304 stainless steel and shall close off all open spaces between walls and interior ceilings.
9. Provide, install and seal with silicone 20 gauge #304 stainless steel base cove at all points where a vertical wall/floor panel meets any building floors creating a 90-degree angle. Provide on interior and exterior of walk-in.

10. Panels shall be soft-nosed and constructed of 4” thick foamed-in-place polyurethane Class 1 UL foam, flame spread of 25 and certified to meet NSF. High density rails and non-insulating materials shall not be utilized in construction.
11. Cam-locks and gaskets shall be foamed-in-place. Use of adhesives and/or fasteners is unacceptable.
12. Provide stainless steel rack to be located where shown on plan for refrigerated system compressor units.
13. Doors and door sections shall be 22 gauge #304 stainless steel front and back with 0.080” textured aluminum or 1/8” aluminum treadbrite kickplates 36” tall factory installed on the interior and exterior; doors hinged as shown on plan. Doors shall have a net opening of 36” x 78”. Handle shall be stationary with slide-bolt or deadbolt locking system with interior safety release. All doors shall be flush mounted, self-closing and include hydraulic door closer. Provide 14” x 14” viewports (heated in low temperature applications). Fiberglass Reinforced Plastic door jambs to have low wattage heater wires and stainless steel thresholds. Three heavy duty, field adjustable cam-lift hinges shall be provided with spring loaded hinges for each door required. All door hinges, handles and automatic closures shall be stainless steel, chrome finished. Bi-parting Clear-View vinyl strip doors with heavy duty rod and hinge assemblies with backing material within the door section are required for each door. All devices shall be mounted with non-corroding or stainless steel hardware. Threshold hardware shall utilize flush mounted flat head stainless steel screws. Do not provide any thermometers on door sections (Modu-larm-75 as specified below is a combination digital thermometer and alarm system).
14. Provide one for each walkin - Modularm-flush mounted 75LC alarm, factory installed and flush mount-ed for each compartment on wall panel adjacent to door section unless a door section is required on an interior wall, in which case the alarm shall be mounted adjacent to the alarm on the wall panel next to exterior entry door of the combination unit. Temperature sensing probe shall be protected with a perforated metal housing. For each walk-in provide a spare contact for a general alarm to be sent to the building automation system.
15. Provide two rows at 6” and 24” of aluminum bumper rails with gray vinyl inserts on all exposed walls and 6” x 6” x 72” tall 0.080” textured aluminum or 0.100” aluminum diamond treadbrite corner guards on all exposed exterior corners.
16. Provide LED light fixtures with low temperature ballasts as shown on the electrical drawing or as required to meet minimum codes. Light fixtures shall be provided and installed by the F.E.C., rigidly mounted per plan with stainless steel fasteners, final connections by the E.C.
17. Conduit runs (exposed) within the walk-in are unacceptable.
18. Any and all penetrations/conduit through walls and/or ceilings shall be sealed with foam and caulked inside and out.
19. Provide with self-supported ceiling. Where ceiling spans exceed the manufacturer’s recommendation for self-supported structures and/or wind/snow load, provide and install the structure necessary to properly support the ceiling panels per the manufacturer’s guidelines.
20. Air-Cooled Condensing Units: All compressors to be Copeland Mfg. or equal, pre-assembled remote systems, UL listed and properly sized for moderate to high use applications to hold + 35 °F for cooler applications and/or –10 °F for freezer applications based on local ambient temperatures. Provide suction accumulators and suction line filter. Provide medium and low temperature defrost timers factory mounted to each condensing unit. All condensing unit components shall be factory built and wired onto a condensing unit base. Provide compressors to work outside with low ambient (-10F) operations. Provide all necessary housing for outside unit including a stainless steel roof curb to match additional curbs provided by others on project. Mount curbs to roof in similar manner as mountings of MUA and fan curbs.
21. Evaporator Coils: Shall be ceiling, end-mount style and shall be UL listed and shall be sized to “balance” with the condensing unit(s). Units to be installed per plans.
22. Use refrigerant most compliant with LEED® standards for both cooler and freezer applications, installed to the highest standards of quality and performance evident in the State. Installation shall be in accordance with all applicable codes and regulations.
23. Provide refrigeration lines that shall be fully insulated with Armstrong “Armaflex” tubing between condensing unit and evaporator coil(s). Refrigeration lines shall be trapped as required.

24. F.E.C. shall provide and connect all components as recommended by the manufacturer. F.E.C. is required to coordinate installation of this item with Other Trades. F.E.C. to provide start-up and adjustment per manufacturer's specifications 96 hours prior to date of completion.
25. F.E.C. to provide 5-year parts and labor warranty on all compressors. Wall, floor and roof panels shall have a 10-year warranty.
26. F.E.C. shall assemble and locate walk-in where shown on plan. F.E.C. shall caulk and seal the bottom of all floor screeds.
27. F.E.C. shall provide and plumb all condensate drain lines to floor drains as shown on plan. Drain lines for freezers shall be heated and all drain lines shall be properly trapped and air gaps provided as necessary.
28. E.C. shall provide, install and wire all required fused disconnects for each condensing unit to the highest standards to meet any and all applicable code requirements.
29. Bearing surface under floor panels must be level and dry. Bottom of panels must have at least 80% contact with floors. FEC to provide sand to fill remaining 20% as needed. The FEC must be able to prove that the surface in which the walk-in floor is to be installed is completely level prior to installing the walk-in cooler or freezer. In the event that the walk-in panels (walls, floors and ceiling) are installed with gaps greater than 1/8", and absence of documentation that the surface was level before installation, the FEC may be required to uninstall the panels, level the surface and reinstall the walk-in at their own cost.

MANDATORY ACCEPTABLE MANUFACTURER: Thermo Kool, Imperial Brown, Bally

ITEM #100.1 WALK-IN FREEZER CONDENSING UNIT – Provided as part of item 100.

ITEM #100.2 WALK-IN FREEZER EVAPORATOR – Provided as part of item 100.

ITEM #100.3 WALK-IN COOLER CONDENSING UNIT – Provided as part of item 100.

ITEM #100.4 WALK-IN COOLER EVAPORATOR -- Provided as part of item 100.

ITEM #101 ENCLOSED PAN RACK

Quantity: Per Drawing
Manufacturer: Cres Cor
Model: 1001833D

Features:

1. Transport Storage Cabinet, mobile, enclosed, 57-3/4" high.
2. Hi-Tensile aluminum exterior & interior, NSF
3. Provide single wall non-insulated, corrugated side walls hold (32) 18" x 26" pans slides on 1-1/2" centers, reinforced door swings 270°, gravity type latch, card clip included.
4. Provide (4) 5" swivel casters (2) braked.

ACCEPTABLE MANUFACTURERS: Advance Tabco, Channel

ITEM #102 PAN RACK

Quantity: Per Drawing
Manufacturer: Cres Cor
Model: 2071820

Features:

1. Utility rack.
2. Provide 5” casters (2 lockable).
3. Provide open sides.
4. Accommodates (20) 18” x 36” sheet pans, slides on 3” centers.
5. Provide welded aluminum construction.

ACCEPTABLE MANUFACTURERS: Cambro, Advance Tabco, New Age, Metro

ITEM #103 DUNNAGE RACK

Quantity: Per Drawing
Manufacturer: Cambro
Model: DRS – Size per drawing

Features:

1. Molded high impact plastic.
2. Slotted top.
3. Color: Speckled Gray (480).

ACCEPTABLE MANUFACTURER: Regency

ITEM #104 STORAGE RACK

Quantity: Per Drawing
Manufacturer: Metro
Model: Metromax 4 – Sized per drawing

Features:

1. 86" post with antimicrobial protection, size per plan.
2. Lockable casters.
3. 15-year warranty against corrosion.
4. Removable polymer shelf mats.
5. Adjustable shelves with antimicrobial protection.
6. Assemble and install racks, making certain that rack shelving does not interfere with door swings, lighting, drains, or any other equipment.
7. Provide 5 shelves.

ACCEPTABLE MANUFACTURER: Eagle Group, Cambro

ITEM #105 DUNNAGE RACK

Quantity: Per Drawing
Manufacturer: Cambro
Model: DRS- Size per drawing

Features:

1. Molded high impact plastic.
2. Slotted top.
3. Color: Speckled Gray (480).

ACCEPTABLE MANUFACTURER: Regency

ITEM #106 STORAGE RACK

Quantity: Per Drawing
Manufacturer: Metro
Model: Metromax 4- Sized per drawing.

Features:

1. 86" post with antimicrobial protection, size per plan.
2. Lockable casters.
3. 15-year warranty against corrosion.
4. Removable polymer shelf mats.
5. Adjustable shelves with antimicrobial protection.
6. Assemble and install racks, making certain that rack shelving does not interfere with door swings, lighting, drains, or any other equipment.
7. Provide 5 shelves.

ACCEPTABLE MANUFACTURER: Eagle Group, Cambro

ITEM #110 LOCKERS – N.I.F.E.C.

ITEM #112 DUNNAGE RACK

Quantity: Per Drawing
Manufacturer: Cambro
Model: DRS- Size per drawing

Features:

1. Molded high impact plastic.
2. Slotted top.
3. Color: Speckled Gray (480).

ACCEPTABLE MANUFACTURER: Regency

ITEM #113 CAN RACK

Quantity: Per Drawing
Manufacturer: Advance Tabco
Model: CR10-162M

Features:

1. Can Rack, mobile design with casters, with sloped glides for automatic can retrieval, designed for #10 & #5 cans, aluminum construction, holds (162) #10 cans, or (216) #5 cans.

ACCEPTABLE MANUFACTURER: Channel

ITEM #115 STORAGE RACK

Quantity: Per Drawing
Manufacturer: Metro
Model: Metromax 4- Sized per drawing.

Features:

1. 86" post with antimicrobial protection, size per plan.
2. Lockable casters.
3. 15-year warranty against corrosion.
4. Removable polymer shelf mats.
5. Adjustable shelves with antimicrobial protection.
6. Assemble and install racks, making certain that rack shelving does not interfere with door swings, lighting, drains, or any other equipment.
7. Provide 5 shelves.

ACCEPTABLE MANUFACTURER: Eagle Group, Cambro

ITEM #130 CUSTOM MILLWORK - MOBILE SCRAPPING STATION

MANUFACTURER: Approved Fabricator

QUANTITY: One (1)

MODEL: Custom Fabricated

FEATURES:

1. Unit to be shaped, sized and located where shown on plan. Construct per drawing details, the requirements of the General Standards and this specification.
2. Counter to be constructed to support all equipment, materials, utilities and products without deflection at any point. In addition, unit shall be able to support 300 pounds of live weight at any point without deflection.
3. Counter shall be constructed as a rigid structure, suitable for use in a foodservice facility of this type. Countertop edge profile per details.
4. Support on heavy duty 6” casters, with appropriate base materials attached as shown on details.
5. Unless otherwise illustrated in the detailed drawings, provide 2" high end or backsplashes wherever the counter meets an adjacent walls or other fixed equipment.
6. Wherever penetrations must be made in the counter to accommodate the passage of utilities, refuse drop holes or other needs, fully sleeve these penetrations so that liquids are prevented from running into the penetration.
7. Interior of the counter shall be constructed to provide storage and service access for the equipment shown on plan. Where the counter cavity is not serving as housing for the counter-based equipment, the remaining space shall be developed as a storage cavity. Each storage cavity shall be provided with cleanable back, bottom and sides, rising from the floor of the cabinet to a height of 12” above the floor. The balance of the cavity should be constructed with a melamine finish. Provide trim strips and other finish materials to allow counter-based equipment to be removed for service, when necessary.
8. Due to variations in construction methods between fabricators, drawing details for counters may not show all of the structural support, mounting methods and utility chases required. The counter(s) must be fabricated to meet the performance needs of the plan, and these specifications (e.g. support the beverage and ice machine without deflection, meet NSF standards, et cetera). The exterior elevations and sections do accurately indicate the exterior needs of the counter including materials, dimensions and shape.
9. The location of counter seams, laminate seams and other visible breaks must be approved by the Architect and Bakergroup. Minimize the visibility of these joints. Surfacing material seams and joints shall be designed to occur where counter angles change. Where there is a need to provide multiple sections along a straight counter, the fabricator will design the seams or surface joints to be evenly spaced across the length of the unit. No seams shall go through any heated equipment such as drop in hot wells or heated shelves.
10. Wherever mobile equipment is to be parked up against any counter, provide and install rigid stainless steel angles along the floor to prevent the parked equipment from bumping into the counter. In addition, provide a trimmed out stainless steel protective surface around the interior of counter cutouts where equipment such as lowerators are to be parked.

11. Provide for all counter doors: Three (3) Rockford Process Control (RPC) Five Knuckle Hinge in 304 stainless steel. NOTE: Where the weight of the hinged mass exceeds the support limits of the hinge, provide acceptable manufacturer hinge options for consideration by Bakergroup. Provide in all locations of doors Hafele Item No. 115.61.601: Wire Handle, Matt, Stainless Steel; grade 304, 96 CTC, 106 mm length.
12. Hinge mounts must be strong enough to prevent the hinges from pulling out of the substrate. Doors, hinges and latches shall be designed for long-term durability and have a 10-year warrantee against failure. Mount hinges per Bakergroup detail, rigidly securing the hinge to the door, using five stainless steel flathead screws for each hinge. Rigidly mount hinges to casework using two ¼" bolts similarly secured with hex flange locknuts with nylon inserts and two 3/16" flathead screws for each hinge. Door Catches: Shall be adjustable heavy duty Amerock Roller Catch BP98232G, Amerock Double Roller Catch Part No. 143 or approved equal. Provide non-magnetic type.
13. All surfaces shall be free of burrs and rough edges.
14. Mounting screws and bolts shall match the material they are securing (e.g. stainless screws to attach stainless metal banding, et cetera).
15. Follow all material and appliance manufacturer's requirements for the handling, fabrication and installation of these items. If any material is deemed unsuitable for the intended use, the F.E.C. must note this in their bid.
16. Provide stainless steel "L" shaped stopper brackets securely mounted to the ground for any equipment on casters built in counter or counter is cut out around. Stopper brackets purpose to hinder equipment from causing destruction of counter.

ITEM #131 TRASH BIN -- O.F.O.I.

ITEM #132 RECYCLING BIN -- O.F.O.I.

ITEM #133 COMPOSTING BIN -- O.F.O.I.

ITEM #135 SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RAN ST-3S

Features:

1. Top, 14 gauge stainless steel 36" unit.
2. 6" swivel casters (2 locking), standard.
3. Stainless steel construction provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
4. Modification for elementary height.
5. Provide latch assembly.

ACCEPTABLE MANUFACTURERS: Duke, LTI Co.

ITEM #136 FLATWARE HOLDER

Quantity: One (1)
Manufacturer: Alegacy Foodservice Products
Model: TCD6

Features:

1. Countertop Dispenser, 14-1/2"L, 11-3/4" deep, 5-1/2" front height, 8-3/8" back height, holds six cylinders, satin finish

ACCEPTABLE MANUFACTURERS: Vollrath, FMP

ITEM #137 SERVING COUNTER

Quantity: One (1)
Manufacturer: Randell
Model: RAN ST-3S

Features:

6. Top, 14 gauge stainless steel 36" unit.
7. 6" swivel casters (2 locking), standard.
8. Stainless steel construction provide laminate panels for front and sides. (Wilsonart Landmark-7981 per architect).
9. Modification for elementary height.
10. Provide latch assembly.

ACCEPTABLE MANUFACTURERS: Duke, LTI Co.

ITEM #138 FLATWARE HOLDER

Quantity: One (1)
Manufacturer: Alegacy Foodservice Products
Model: TCD6

Features:

1. Countertop Dispenser, 14-1/2"L, 11-3/4" deep, 5-1/2" front height, 8-3/8" back height, holds six cylinders, satin finish.

ACCEPTABLE MANUFACTURERS: Vollrath, FMP

PART 3 - EXECUTION

3.1. EXAMINATION

A. Verify Project Conditions: The F.E.C., before beginning work, shall examine the space and existing conditions and shall report to Architect and/or C.M. any conditions which prevents the F.E.C. from executing the work as required under the contract.

B. Take Field Dimensions: The F.E.C. shall take all field dimensions and shall be responsible for accurately incorporating them into their shop drawings, as-built drawings and will also be responsible thereafter for any problems with fit, closure, access, connection, code compliance, circulation or finish which results from any lack of timely work on the part of the F.E.C. delayed by failing to accomplish this requirement.

C. The F.E.C.'s millwork fabricator shall meet with Design Team at the Grand Rapids, Michigan office prior to preparation of shop drawings, to review expectations of millwork fabrication and shop drawings.

D. Coordinate with Other Trades: The F.E.C. shall coordinate the locations of chases, grease traps, troughs, floor recesses, roll-up doors and passage ways to ensure that the locations are correct and not conflicting with equipment, columns, footings, equipment bases, legs, et cetera.

E. Verify Installation: The F.E.C. shall verify that products (furnished under this section for installation and under any other Project Contract Document work affecting their work) have been correctly installed.

1. F.E.C. is solely responsible for delivering the foodservice equipment. The F.E.C. shall visit the site to ensure that large pieces of equipment will fit through doors, into elevators, down steps, et cetera. If lifting equipment is required to place foodservice equipment properly, the F.E.C. shall contract and bear the cost of the lifting equipment and personnel required.

2. F.E.C. shall make certain that all equipment is delivered to the site in time to fit through access passages on the path to their final locations.

F. Coordinate Counter Detailing: In detailing fixtures, the F.E.C. shall consult with piping and electrical contractors to be certain that due space allowance is made for passage and mounting of their work, particularly under lower shelves of cabinets and counters. The F.E.C. shall also counsel the trades, instructing them to keep utility runs tight to the un-used areas of the structures which these utilities are passing.

G. Walk-in Refrigeration: The F.E.C. shall verify the size of the space allocated for walk-in cooler and freezer units. If a recessed floor is being used, verify the size and slope of the recess. FLOOR IS TO BE LEVEL. DO NOT PROCEED IF CONDITIONS ARE UNSATISFACTORY FOR A PROPER INSTALLATION. Follow manufacturer's recommendations in determining relevant requirements. F.E.C. shall make certain that refrigeration systems supplied are of sufficient capacities to maintain proper temperatures in heavy use conditions and high temperature environments.

H. Base and Curb Dimensions: F.E.C. shall measure to verify that curbs and bases are level, properly sized and correctly located. Do not proceed if conditions are unsatisfactory.

I. Utility Rough-In Points: The F.E.C. will be responsible for accurately measuring the site and producing mechanical, electrical and detail drawings that will GUIDE OTHER CONTRACTORS in the work they perform in support of the foodservice plans. Once rough-ins are complete, the F.E.C. shall visit the site to measure, document and determine that the precise location of utility rough-in points exactly matches the needs of the equipment and designer’s intentions; verify against plans and drawings. Revise shop drawings to show actual locations of utility services. Issue this inspection report to the C.M., and/or Architect.

J. Ventilation Systems: All air exhaust and supply systems must be designed to prevent air flow cross-currents from occurring near foodservice ventilation hoods. Even low velocity cross-currents can easily undermine the ability of any hood to properly capture smoke and particulates. Island-style hoods are especially sensitive to the presence of cross-currents.

1. The F.E.C. shall attend all meetings related to discussions of ventilation systems at their cost.

2. F.E.C. shall coordinate with the hood manufacturer and the ventilation contractor to ensure hood design and fan sizes are appropriate for the equipment located under the hoods. The F.E.C. shall provide accurate ventilation requirements for all equipment located under the hood(s) and provide documentation of this coordination to the C.M. All hood ventilator designs must match the system variables, as designed. For example: if a larger fan is required to achieve performance at the level specified to accommodate a particular manufacturer, the F.E.C. will be responsible for the additional cost of the fan, ductwork, controls or other increases in the overall cost of the system compelled by the change to the acceptable manufacturer. The F.E.C. will also be responsible for any engineering costs incurred for re-designing the system to accommodate the acceptable manufacturer system. This includes any additional testing and balancing needed to verify system performance.

K. Timing of Examinations: F.E.C. shall examine field conditions in a timely manner, so as not to impede the progress of the project. Perform on-site inspection of utilities as they are roughed-in to make certain that specified locations are appropriate and in keeping with the design. This inspection shall be made before floors are poured or walls covered. The F.E.C. shall be responsible, thereafter, for the costs associated with reworking any building or infrastructure to properly accommodate the equipment specified.

L. Equipment Operations: F.E.C. will make certain that all equipment specified will operate properly as shown on the plan. If any piece of equipment fails to function, correctly, where located, the F.E.C. will be responsible for advising Architect and/or C.M. of the conflict. The F.E.C. has final responsibility for making certain that the equipment will, ultimately, function as intended.

3.2. INSTALLATION

A. Notice to Proper Authorities: The F.E.C., at such time so as not to impede the progress of the project, shall give to the proper authorities all notices as required by law relative to the work in their charge including the Public Health Department or State Regulatory Agencies and State Fire Marshal; obtain all official permits, licenses, et cetera, and pay such proper and legal fees to public officers and others as may be necessary for the faithful performance of the work.

B. Sealing, Closed Bases: Certain fixtures and counters will have closed bases. The F.E.C. shall erect these items, using approved mastic or silicone compound to effectively seal out all space for vermin and eliminate spaces for water to stand.

1. Openings for pipes in walls or bottom of food compartments shall be tightly sealed against the entry of vermin.

2. Reinforcing and framing members that are not totally enclosed or within walls are to be used in such a manner as to be easily cleanable.

3. All framing members shall be constructed and installed so as to eliminate raceways, which facilitate harboring of vermin.

4. The ends of all hollow sections shall be sealed.

5. Where fixed panels are applied to the outside or inside or set into an angle or other reinforced body or counter frame, the method of fastening shall be such as to minimize projections and openings.

C. Access Panels: Access panels are to be used for access to drains and junction boxes ONLY. Access panels are not to be used for any plumbing or electrical chases. The plumbing and electrical lines shall be drilled or punched through sides, tops, shelves and bottom of counters and cabinets. These holes will be the same diameter as the pipe or conduit and sealed with silicone. The penetrations shall be made as far back and off to the sides as possible. Piping shall not interfere with the operation of equipment or storage of product. All piping shall be secured in-place.

D. Set in Place: Set each item of non-mobile and non-portable equipment securely in place; level and adjust to correct height.

E. Support Equipment: Anchor equipment to supporting substrate where indicated or where needed for sustained operation and use without shifting or dislocation. Conceal anchorages where possible.

F. Anchors and Chair Carriers: Where indicated or needed for safety of the equipment operator, anchor equipment to floor or wall with stainless-steel screws or bolts.

G. Seismic Restraints: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated.

H. Coordination with Other Trades: The F.E.C. is to proactively provide installation and connection information and guidance to the C.M., M.C., E.C., P.C. and others as appropriate to each piece of foodservice equipment in the project with regard to the rough-in of utilities, floor preparation, placement and connection of the equipment, building access for delivery, utility loads and other requirements, as necessary, to ensure that equipment is protected; installed and performs as specified; and the Project Contract Document specifications, and all prevailing code requirements are met.

I. Deliver to other contractors all loose plumbing parts, floor troughs, steam fitting, ventilation and electrical parts that are a part of the equipment or the work under this contract, or required for their proper installation, and give instructions for their proper installation of each item.

J. Level Counters and Tables: Adjust countertops and other work surfaces to level tolerance of 1/16 inch maximum offset and maximum variation from level or indicated slope of 1/16 inch per four (4) foot.

K. Field Joints: Complete field-assembly joints in work (joints which cannot be completed in shop) by welding, bolting-and-gasketing or similar methods as required. Set or trim gaskets flush, except for "T" gaskets as indicated. Field joints in fabricated equipment

shall be welded and work surfaces ground and polished on premises, so that upon completion each item of equipment will have true, smooth and even surfaces. Filling with solder is not permitted.

L. Connected Equipment: As distinct from field joints, where a single item of equipment must be shipped and brought into the project site in two or more sections that are welded into one unit, there are instances when two separate pieces of equipment are to be connected. For example, a dishwashing machine and the clean dishtable need to be attached. The F.E.C. shall make these connections rigid and strong by bolting the units together and sealing the joint with minimal amounts of silicone caulking. Under no circumstances shall caulking alone or excessive caulking to fill voids, be acceptable. Joints are to be watertight. Caulk shall only be applied after taping the adjacent surfaces to minimize caulk smearing on to adjacent surfaces. Failure to tape prior to caulking may result in the need to remove the caulk, restore the adjacent surfaces, and re-caulk.

M. Enclosed Spaces: Treat spaces that shall be inaccessible after equipment installation, by covering horizontal surfaces with powdered borax at rate of 4 ounces per square foot.

N. Closure Plates and Strips: Install where required, with joints coordinated with units of equipment.

O. Cut-Outs: The F.E.C. shall provide cut-outs in foodservice equipment where needed to run soda, plumbing, electric, gas or steam lines through equipment items for final connections. These cutouts are to be made at the factory when possible. If a field cut-out is required it will be made just large enough for the piping and in a concealed location. All cut-outs will be sealed and vermin proof. F.E.C. shall sleeve each cutout to prevent liquids from entering.

P. Sealants and Gaskets: Install all around each unit to make joints air-tight, watertight, vermin-proof and sanitary for cleaning purposes. Where necessary, use backer rod to shape sealant bead properly, at 1/4-inch depth. Shape exposed surfaces of sealant slightly concave, with edges flush with faces of materials at joint. At internal corner joints, apply sealant or gaskets to form a sanitary cove, of not less than 3/8-inch radius.

Q. Existing/Relocated Equipment: F.E.C. shall remove existing/relocated equipment from storage and set in place. Final connections shall be by other trades. Test each existing item for proper operation and deliver to Owner in proper working condition or in specified condition.

R. Refrigeration Lines: F.E.C. shall provide and install all connecting refrigeration lines between evaporator coils and condensing units. F.E.C. is to closely coordinate the location of these lines, evaporator coils, condensing units and all necessary components with the C.M., sizing them to accommodate building passages. All penetrations shall be sealed. All refrigerant lines shall be installed to the highest standards and in compliance with all prevailing codes. Once installed, F.E.C. shall properly evacuate and charge all lines with a refrigerant suitable to the manufacturer of the units, and to the Owner. Any special and additional equipment needs necessitated by the length of the refrigerant line runs will be the responsibility of the F.E.C. F.E.C. shall provide the C.M. with written documentation indicating the refrigerant type and quantities used.

S. Existing Refrigeration Removal: Existing refrigeration equipment that is not scheduled to be re-used shall be removed and disposed of properly by the F.E.C. or another appointed individual that the F.E.C. determines is certified. They will certify to the EPA that they have acquired recycling or recovery equipment and are complying with certification requirements for the disposal of the refrigerant set forth by the architect and/or C.M.

3.3. FIELD QUALITY CONTROL

A. Supervision: F.E.C. is to provide a competent field supervisor during the installation of this part of the Work.

1. The field supervisor shall attend scheduled progress meetings. If the field supervisor or the F.E.C.'s representative underperforms, as determined by the C.M., the F.E.C. shall assign a new representative to the project within a two-week period.

2. The field supervisor shall supervise the installation of the equipment and connections and will counsel with other contractors in regard to those connections and installation. The F.E.C. will designate a representative of their firm to REPRESENT THE F.E.C. AT ALL PROJECT MEETINGS WHERE FOODSERVICES ARE A MEANINGFUL PART OF THE DISCUSSION. This representative is contractually obligated to provide timely support for the project, both in the execution of their work and in counseling the other trades whenever there is a need for product information, installation instructions, et cetera.

3. The F.E.C. will work closely with the site supervisor of the owner; and will establish with the site supervisor of the owner the schedule of foodservice equipment shop drawings, fabrication, order placement, delivery, installation, training, and punch list dates. That schedule must be satisfactory to all contractors affected by the F.E.C.'s work. A copy of this schedule should be sent, within two (2) weeks of contract award, to Architect and/or C.M. Schedules must incorporate the delivery of fabricated foodservice equipment to the site three (3) months in advance of installation.

4. On a monthly basis, the F.E.C. and their fabricators shall submit electronic progress reports to the site supervisor and to Architect and/or C.M. The F.E.C. and their fabricators shall complete and submit each progress report by the 7th day of the month, emailing the completed, signed form to those designated by the Owner or Owner's representatives. There will be a $250 late penalty, payable as a credit to the project, for each late progress report or for the failure of the F.E.C. to submit the update. Late penalties shall be assessed on the 25th of the month, unless an extension is authorized in writing by Architect or the C.M.

5. Each progress report shall indicate the status of shop drawings and other submittals, the status of fabricated items, of orders placed, of equipment received and installed and other information as determined at the onset of the project. The report must identify deviations from original schedule plan, any anticipated challenges and/or delays to meeting the schedule and the steps the F.E.C. has

taken to rectify the issues. A progress report form will be provided to the F.E.C. and their fabricators for submission of this information.

6. If the F.E.C. falls behind in the performance of their work, as determined by Architect and/or the supervising member of the Project Team, the F.E.C. may be charged for the additional costs caused by their performance delay. The F.E.C. agrees to this clause and also agrees to pay all personnel, material and overtime charges accrued by any non-F.E.C. personnel who must be utilized in the event the F.E.C. is unable or unwilling to perform as specified or in a timely manner. Any charges accrued will be deducted from the F.E.C.'s contract payment and paid to those incurring costs for the work. Additionally, if the performance delay results in a need to establish temporary foodservices, the F.E.C. will be responsible for all costs of setting up the temporary operation, any additional costs incurred due to running the temporary operation and all costs to disband the temporary operation.

7. The F.E.C. shall arrange for instruction of the operators of each piece of equipment in its proper use and provide training to the satisfaction of Owner. Training shall be conducted by factory-authorized service representative to perform startup services and owner demonstration and training (sales representative does not qualify as factory-authorized service representative). The Owner shall be permitted to video record the training presentation and to retain a copy to the Owner for the Owner's internal use only. Repeat visits to the site may be required and should be anticipated. Coordinate final list of equipment needed to be trained on with owner before setting up. Owner shall make final decision on what equipment needs training on.

B. Weather, Labor Issues, Et cetera: The F.E.C. is cautioned to anticipate the required work required for this project. Consideration should be given to weather, labor issues, factory production schedules and other issues relating to the performance of the F.E.C.'s work or work under the Foodservice Equipment Contract. No additional monies will be paid for delayed work resulting from the F.E.C.'s failure to anticipate the scope of the work required for this project.

C. Equipment Fit: The F.E.C. will make certain that all equipment specified will fit into the spaces provided. If any piece of equipment will not fit where drawn, the F.E.C. will be responsible for advising Architect and/or C.M. of the conflict. The F.E.C. has final responsibility for making certain that equipment will fit as shown and specified.

Where racks or storage shelving are specified to be a certain length, height and width, the F.E.C. will verify that the specified racks will fit as shown and specified and will not interfere with plumbing lines, evaporators, electric conduit or other obstructions to the placement of the rack as shown.

Should the F.E.C. find that any item may not fit as drawn; the F.E.C. must send communication via email to Architect and/or C.M. describing the situation and the proposed solution. Verbal communication does not constitute adequate notification.

3.4. INSTALLATION OF EQUIPMENT:

The F.E.C. shall install the equipment at the site in full compliance with all applicable codes, rules and regulations of the Local, State and Federal governing agencies. If, because of jurisdictional trade agreements or other conditions, any work specified to be performed under this contract must be done by others, the F.E.C. shall sub-let such work to those who may be qualified to do such work or make other arrangements at the F.E.C.'s expense as may be approved by Architect and/or C.M.

During the installation, the F.E.C. must protect all surfaces that might be damaged during the installation of the foodservice equipment. This includes the need to protect wall, roof, ceiling, floors, and passageways. The F.E.C. will be responsible for the orderly repair and restoration of any surfaces that incur damage resulting from their work.

3.5. DELIVERY OF FABRICATED ITEMS

If it becomes necessary to schedule construction so that all partitions will be erected prior to the delivery of the foodservice equipment, bidders are cautioned that all equipment must be fabricated so that it can be move though finished door openings.

It is recommended that the F.E.C. document the condition of the fabricated equipment upon installation at the site with detailed photographs. The digital photos should be taken <u>after installation.</u> The pictures should be of sufficiently high resolution and quality to illustrate the condition of the equipment depicted. The photographs will be accepted by Architect and/or C.M. as a record of the condition of the equipment at installation and <u>may</u> be used to assign responsibility when damages are noted during subsequent site inspections.

3.6. INSPECTIONS BY REGULATORY AUTHORITIES

The authorized representative of State, Local and Owner inspectors and/or Architect shall have access to the work at all times wherever it is in progress or preparation. The F.E.C. shall arrange a convenient time and access for such inspection.

Inspection by Architect and/or C.M.: Architect and/or C.M. shall have free access to the F.E.C.'s shop or shops during the duration of this project for the purpose of making inspections to see that plans, specifications and detail drawings are being adhered to carefully. The F.E.C. shall correct any errors found during these inspections to the extent and within the scope of the plans, specifications, detail drawings and within the conditions of this contract.

3.7. CONDEMNATION PROCEDURES

Material delivered to the site may be inspected by the Owner or C.M. The F.E.C. shall, within 24 hours after receiving written notice to that effect, shall proceed to remove from the grounds or building all materials, fixtures or apparatus condemned in that inspection, whether the same shall be worked or unworked, or take down and remove all portions of the work which was deemed as failing to conform to the drawings and specifications and to the conditions of the contract. In the event that a piece of equipment is rejected for cause, the F.E.C. bears all costs, including, but not limited to, packaging, freight and restocking fees.

3.8. TESTING

Testing: Do not start foodservice equipment until service lines have been tested, balanced, and adjusted for pressure, voltage and similar considerations; and until water and steam lines have been cleaned and treated for sanitation. Before testing, lubricate and prep equipment in accordance with manufacturer's recommendations. Start-up and testing shall be performed by a service agency certified by the manufacturer or fabricator of each item.

A. Test each item of operational equipment to establish that it is operating properly and that all controls and safety devices are functioning.

B. Replace equipment or components of equipment which are found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

3.9. CLEANING

A. Cleaning During Project Progress: Clean up all debris made by F.E.C. personnel as work progresses, leaving all work spaces as clear as reasonable. At the close of each work day, secure the work site so to prevent injury or accident to others. The F.E.C. will be responsible for injuries resulting from failure to secure the work environment associated with their work.

B. Remove Coverings and Clean: After completion of installation and completion of other major work in foodservice areas, remove packaging, protective coverings, labels and clean foodservice equipment internally and externally, so that surfaces are free of grime, grease and manufacturers oils.

C. Restore Damaged Finishes: Restore exposed and semi-exposed finishes to remove abrasions and other damage. Polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored to the satisfaction of the Owner.

D. Final Cleaning: After testing and start-up, and before Substantial Completion, clean and sanitize foodservice equipment and leave in condition ready for use. The F.E.C. shall contact the Owner to visually inspect the cleaned foodservice equipment and shall provide the Owner with a form that once signed by the Owner, will confirm that the cleaning was performed to a satisfactory level. A copy of the signed statement will be sent to Architect and/or C.M. The F.E.C. will re-clean any equipment identified by the Owner as not cleaned to a satisfactory level. If the F.E.C. fails to clean the equipment to a satisfactory level, the F.E.C.’s contract may be back-charged for cleaning performed by the Owner or the Owner’s representatives.

3.10. DEMONSTRATION AND TRAINING

A. Demonstration: In the presence of Architect and/or C.M. and the Owner, demonstrate that each item functions as specified.

B. Instruction: Provide comprehensive on-site instruction in the proper operation and typical use of each piece of equipment. Instruction shall be provided to the Owner or designated person(s) at or near a date set by Owner at the completion of this project. Instruction shall

be to the satisfaction of the Owner. In the event that a component of operation is phased to begin at a later date than the completion of the project, the Owner shall be able to establish the date for training close to the start-up of the operation. Training shall be conducted by equipment manufacturers representatives, who are factory trained, are certified for the specific model of equipment, and have specialized operating and service knowledge of the equipment. The Owner shall be permitted to video-record the training presentation and to retain a copy for the Owner's internal use only. Training shall include operational performance and preventative maintenance requirements. This may require separate presentations for staff who operate the equipment and staff who perform preventative maintenance, to be determined by the Owner. Instruction shall be to the satisfaction of the Owner. Repeat visits to the site may be required and should be anticipated. Six months after the last date of training for each piece of equipment, the F.E.C. shall have the Owner sign off for each piece of equipment to indicate training was satisfactory and is complete.

3.11. WARRANTIES AND GUARANTEES

A. Period of Guarantee and Remedies: The F.E.C. shall guarantee materials and workmanship on ALL new equipment and all improved equipment for a period of 24 months from the date of acceptance by the Owner (Substantial Completion) and shall leave the work in perfect condition at completion. Should defects develop within the guarantee period, the F.E.C. shall, upon written notice, remedy the defects and reimburse the Owner for all damage to the other work, whether caused by the defects or by the work of correcting the defects. Guarantee shall cover all labor, parts travel and incidental expense.

1. All equipment for a period of 24 months.

2. For refurbished equipment, the warranty shall be limited to the repairs made to the equipment for a period of 24 months.

3. All compressors shall be warranted for the longer of 5 years or the manufacturer's warrantee period.

4. All walk-in refrigeration systems shall be warranted for the longer of 5 years or the manufacturer's warrantee period.

B. Repeated Warranty Calls: If a particular piece of equipment requires two or more service calls within a one-year period, the F.E.C. will extend the warranty period for another year. This clause may be repeated for the same equipment item.

C. The F.E.C. shall provide to the Owner a list identifying the service/repair companies providing warranty work for each piece of equipment; this list is subject to approval by the Owner. Warranty work shall be scheduled within 24 hours of notice of an issue, with the repair occurring within 2 business days. The Owner and the F.E.C. shall determine the process for communicating warranty repairs.

3.12. PUNCH LIST

A. Preliminary Punch List: The F.E.C. shall prepare an internal punch list and complete this list prior to completion of the project. This shall be done to minimize the final punch list

and the time to complete the final punch list. Should defects arise, the F.E.C. shall repair, replace, or, if necessary, notify the appropriate service agents that the equipment is deficient.

B. Punch List: The F.E.C. shall complete all punch lists in a timely manner acceptable to the Owner. When the project is completed and ready for inspection, the F.E.C. shall contact Architect and/or C.M. via email, advising them that the work is complete; all equipment is on-site, in-place, connected, cleaned, calibrated, tested, operational and ready for inspection. Digital documentation of each piece of equipment shall be provided to support the written statement. If Design Team is required to make additional trips to the site after the punch list inspection, the F.E.C. agrees to pay all costs incurred for each additional visit.

3.13. FINAL SUBMITTAL

Final Submittal: The F.E.C. shall submit to the Owner in a timely manner prior to opening the facility, all final submittal listed below. These shall be submitted in one (1) package at one time.

A. Operator and maintenance manuals, per Section 1.5.

B. All keys, each clearly labeled; three (3) for each lock. Provide keyed alike locks for multiple pieces of equipment per area.

C. F.E.C. prepared as-built drawings (see requirements). This requirement includes all shop drawings, rough-in drawings, elevations, section views and plans. As-built drawings must show what was actually installed on site and all changes must be identified. These drawings must be in a drawing AND electronic CAD and/or BIM format acceptable to the Owner, Architect, C.M. and Architect. Provide final drawings in DXF and AutoCAD TM 2007 or more recent version as indicated by owner.

D. Electronic copies of the buy-out documents (as-built).

3.14. CLARIFICATION

A. Questions: Questions concerning the foodservice equipment and these specifications, either before bidding or after the award of the Foodservice Equipment Contract should be addressed to the Architect and/or C.M. or as per contract documents.

B. Discrepancies: It is intended that the F.E.C. will provide the work described in the Contract Documents for this project. Where there is a discrepancy between the drawings and the written documents, the F.E.C. will provide, item for item, those items indicated on one but not the other or the more expensive model and/or quantity of items indicated AND CONSPICUOUSLY NOTE THE DISCREPANCY ON THE BID FORM. For example, a table will be provided by the F.E.C. if shown on plan but not indicated in written specifications. No additional monies will be granted to the F.E.C. if they fail to note the discrepancies on their bid form.

C. Interpretations: Architect and/or C.M. will issue final and binding interpretations regarding foodservice work contained in the foodservice bid documents.

END OF SECTION 114000

SECTION 115213
PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Electrically operated, front-projection screens.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for metal support framing for front-projection screens.
   2. Section 061000 "Rough Carpentry" for wood backing for screen installation.

1.3 DEFINITIONS

A. ALR: Ambient-light rejection; for specular reflective viewing surfaces, measured as the percentage of ambient light striking the viewing surface that has equal angles of incidence and reflection.

B. Gain: Ratio of light reflected from viewing-surface material to that reflected perpendicularly from a magnesium carbonate surface as determined in accordance with SMPTE RP 94.

C. Half-Gain Angle: The angle, measured from the axis of the viewing surface to the most central position on a perpendicular plane through the horizontal centerline of the viewing surface, where the gain is half of the peak gain.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:

   1. Drop heights.

2. Location of seams in viewing surfaces.
3. For end-mounted motors, location of screen centerline relative to ends of screen case.
4. Anchorage details, including connection to supporting structure for suspended units.
5. Details of juncture of screen case or trim with adjacent finishes.
6. For electrically operated units, wiring diagrams and location of wiring connections.
7. Accessories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver front-projection screens until spaces are enclosed and weathertight, wet-work in installation spaces is complete and dry, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions planned for building occupants during the remainder of the construction period.

B. Store front-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.7 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC system components, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain viewing surfaces and accessories, including mounting hardware, from screen manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Viewing-Surface and Masking Materials:

1. Mildew-Resistance Rating: Zero or 1 when tested in accordance with ASTM G21.
2. Flame Resistance: Passes NFPA 701.
3. Flame-Spread Index: Not greater than 75 when tested in accordance with ASTM E84.

2.3 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General Requirements: Manufacturer's standard units, consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by Underwriters Laboratories Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a metal rod, with ends of rod protected by plastic caps.

B. Wall-Mounted, Metal-Encased, Electrically Operated Screen: Motor-in-roller unit with screen case fabricated from formed-steel sheet or from aluminum extrusions with manufacturer's standard finish and matching end caps.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Basis of Design: DA-Lite Model 70262L
    b. Draper Inc./ Equal
    c. Alltec Screens; a brand of Alltec Pro. / Equal
    d. Screen Innovations. / Equal
    e. Stewart Filmscreen Corporation. / Equal

2. Motor in Roller: Instant-reversing motor of size and capacity recommended in writing by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
3. Controls: Remote, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

    a. Provide with one control switch.
    b. Provide power supply for low-voltage systems if required.
    c. Provide locking cover plates for switches.

4. Wall-Mounting Configuration: Mounted on wall, as indicated on Drawings, with concealed mounting.
5. Screen-Case Color: White.

6. Tab-Tensioned, Gain-White Viewing Surface: Minimum peak gain of 1.3 and 75-degree minimum half-gain angle. Provide viewing surface with black backing and without seams.

    a. Tab Tensioning: Durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of entire height of screen by tabs, to pull viewing surface flat horizontally.

7. Size of Viewing Surface: 189 inches diagonal, HD Progressive Contrast Material (16:10) Format.
8. Extra Drop Height: As needed at top of screen for bottom of screen to be 36 inches above floor.

    a. Color: Black

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated on Drawings to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor them to supporting substrate in a manner that produces a smoothly operating screen that, when lowered, has flat viewing surface and plumb vertical edges.

    1. Install low-voltage controls in accordance with NFPA 70 and complying with manufacturer's written instructions.

        a. Wiring Method: Install wiring in raceway, except in accessible ceiling spaces and in gypsum board partitions, where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables, except in unfinished spaces.

    2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
    3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

END OF SECTION 115213

SECTION 116623
GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Basketball equipment.
2. Volleyball equipment.
3. Safety pads.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installation of floor insert sleeves to be cast in concrete slabs and footings.
2. Section 096566 "Resilient Athletic Flooring" for game lines and markers.

1.3 DEFINITIONS

A. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).

B. FIVB: Federation Internationale de Volleyball (The International Volleyball Federation).

C. NCAA: The National Collegiate Athletic Association.

D. NFHS: National Federation of State High School Associations.

E. USAV: USA Volleyball.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.

2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
3. Include transport and storage accessories for removable equipment.

C. Samples for Verification: For the following products:

1. Basketball Net: Full size.
2. Pad Fabric: Wall padding not less than 3 inches square with specified treatments applied. Mark face of material.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of gymnasium equipment.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.9 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Basketball backboard failures including glass breakage.
b. Faulty operation of basketball backstops.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain gymnasium equipment from single source from single manufacturer.

2.2 BASKETBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper Inc.
2. Performance Sports Systems.
3. Porter Athletic Equipment Company.

B. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rules Book."

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Provide manufacturer's recommended connections complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Overhead-Supported Backstops:

1. Folding Type: Provide manufacturer's standard assembly for side-folding backstop, with hardware and fittings to permit folding. Refer to drawings for direction.
2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.

    a. Center-Mast Frame: Welded and bolted or clamped with side way bracing.

3. Goal Height Adjuster: Adjustable from 8 to 10 feet with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.

    a. Operation: Electric with integral gear-drive motor, with limit switches preset to goal heights and the following:

        1) One detachable electric control device(s).

F. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.

1. Retractor Device: Manufacturer's standard device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per folding backstop.

G. Winch: Hoist, consisting of heavy-duty, fully enclosed worm-gear; brake; cable drum; cable; and fittings, for mounting on wall; designed to move and hold backboard in any raised or lowered position.

1. Portable Winch Operator: One portable electric motor-drive device(s) including adaptor to fit crank mechanism.

H. Basketball Backboards:

1. Shape and Size:

    a. Rectangular, 72 by 42 inches width by height.

2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:

    a. Glass: Not less than 1/2-inch-thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, brushed-natural-finish, extruded-aluminum frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.

1) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.
2) Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.

3. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.

I. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.

1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.

J. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
3. Breakaway Characteristics: Positive-lock movable breakaway design, with manufacturer's standard breakaway mechanism including preset pressure release, set to release at 230-lb load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.
4. Mount: Rear.
5. Net Attachment: No-tie loops for attaching net to rim without tying.
6. Finish: Manufacturer's standard finish.

K. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:

1. Competition Cord: Antiwhip, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.

L. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.

1. Attachment: Bolt on.
2. Color: As selected by Architect from manufacturer's full range.

2.3 VOLLEYBALL EQUIPMENT

A. Provide volleyball sleeves, post with winches and padding and nets with cable covers, sideline markers and antenna. Sleeves shall be installed per manufacturer requirements and coordinated with flooring contractor.

1. Floor sleeves: 3-inch sleeve with 8 inch brass covers for A3 Plus Volleyball System.

   a. Manufacturer: Schelde Sports

2. Volleyball Posts: Pair of A3 Telescopic 3” Aluminum post, winch, and end.

   a. Manufacturer: Schelde Sports

3. Volleyball Net: 9.8m net with 12.5 Kevlar tension cord, pair of antennas and sideline markers.

   a. Manufacturer: Schelde Sports

2.4 SAFETY PADS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper Inc.
2. Performance Sports Systems.
3. Porter Athletic Equipment Company.

B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, not less than 14-oz./sq. yd and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Not less than 3/8-inch-thick plywood, mat formed, or composite panel.
2. Fire-Resistive Fill: Multiple-impact-resistant foam not less than 2-inch-thick, fire-resistive neoprene; 6.0-lb/cu. ft. density.
3. Size: Each panel section, 24 inches wide by not less than 72 inches long.
4. Number of Modular Panel Sections: As indicated.
5. Installation Method: Concealed mounting Z-clips.

6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range one color.

E. Column Safety Pads: Pads covering exposed flange of columns to height indicated, consisting of not less than 1-1/4 inch thick, multiple-impact-resistant, closed-cell, polyethylene-foam filler, covered on both sides and all edges by fabric covering with backer board and manufacturer's standard anchorage to column.

1. Length: Each pad not less than 72 inches.
2. Fabric Covering Color: Match color of wall safety pads for one color.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
3. Steel Sheet: ASTM A 1011/A 1011M.

C. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope with a breaking strength of 7000 lb. Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.

D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, zinc-plated steel connectors and hangars.

E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.

G. Softwood Plywood: DOC PS 1, exterior.

H. Particleboard: ANSI A208.1.

I. Equipment Wall-Mounted Board: Wood, neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

J. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

K. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure, subgrades, subfloors, and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.

1. Floor Insert Location: Coordinate location with application of game lines and markers, and core drill floor for inserts after game lines are applied.
2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and floor-plate type.
3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs and footings. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall and Column Safety Pads: Mount with bottom edge as indicated on drawings.

F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

G. Connections: Connect electric operators to building electrical system.

H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect, and store units in location indicated on Drawings.

3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

SECTION 116643
SCOREBOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES
- A. Single-sided LED basketball scoreboard

1.02 REFERENCES
- A. Standard for Electric Signs, UL 48
- B. Standard for CSA C22.2 #207
- C. Federal Communications Commission Regulation Part 15
- D. National Electric Code

1.03 SUBMITTALS
- A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.
- B. Shop drawings: Submit mechanical and electrical drawings.
- C. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Product delivered on site
- B. Scoreboard and equipment to be housed in a clean, dry environment

1.05 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install scoring equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.
- B. Field Measurements: Coordinate scoreboard location and height with the customer. Verify dimensions by field measurements.
- C. Supply weight and mounting method for Architect to verify that building structure is capable of supporting the scoreboard's weight in addition to the auxiliary equipment.

1.06 QUALITY ASSURANCE
- A. For indoor use only
- B. Source Limitations: Obtain each type of scoring equipment and electronic displays through one source from a single manufacturer.
- C. ETL listed to UL 48
- D. NEC compliant
- E. FCC compliant
- F. ETLC listed to CSA 22.2 #207

1.07 WARRANTY

A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects
B. Provide toll-free service coordination
C. Provide technical online and phone support during Daktronics business hours

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Daktronics, Inc., 201 Daktronics Drive, P.O. Box 5128, Brookings, SD 57006-5128
B. Or approved equal.

2.02 PRODUCT

A. Daktronics BB-2155 single-sided basketball scoreboard displays period time to 99:59, HOME and GUEST scores to 199, PERIOD to nine, team FOULS to 19, PLAYER number to 99, player FOUL to nine, T.O.L. (time outs left) to nine and indicates possession and bonus. During the last minute of the period, scoreboard displays time to 1/10 of a second. Scoreboard can also score volleyball, wrestling and any sport requiring a clock, score and period function. New scoreboard to match scoreboards in existing Gym.

2.03 SCOREBOARD

A. General information
   1. Dimensions: 6'-0" (1.83 m) high, 10'-0" (3.05 m) wide, 0'-6" (152 mm) deep
   2. Base weight: 260 lb (118 kg) – options may increase weight
   3. Base power requirement: 220 W – options may increase wattage
   4. Color: provide over 150 colors to choose from
B. Construction
   1. All-aluminum construction
   2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick
   3. Cabinet withstands high-velocity impact from air-filled sports balls without the need for protective screens
C. Digits & Indicators
   1. LED digit technology
      PanaView® (PV) – discrete LEDs protrude through the scoreboard face
   2. LED color:
      Amber clock/colon, PERIOD, PLAYER/FOUL and T.O.L. digits and bonus indicators with White score and FOULS digits and possession indicators.
   3. Clock and score digits: 13" (330 mm) high
   4. PERIOD, FOULS, PLAYER/FOUL and T.O.L. digits: 10" (254 mm) high
   5. Bonus indicators: 4" (102 mm) high
   6. Possession arrows: 3" (76 mm) high
   7. Seven bar segments per digit
D. Captions
   1. Vinyl applied directly to scoreboard face
   2. HOME and GUEST captions: 6" (152 mm) high
   3. PERIOD, FOULS/SCORE, PLAYER/FOUL/MATCH and T.O.L. captions: 4" (102 mm) high
   4. Color: standard white or others available upon request
E. Horne
   1. Vibrating horn mounted inside the scoreboard cabinet behind the face
   2. Sounds automatically when period clock counts down to zero

3. Sounds manually as directed by operator

F. Power Cord
1. Cord is 11' (3.35 m) long
2. Cord plugs into a standard grounded outlet

G. Accessory Equipment
1. Vinyl striping applied around the clock and scoreboard face.
2. Two 6" (152 mm) high Programmable Team Name Message Centers (TNMCs) in place of vinyl HOME and GUEST captions – add 15 lb (7 kg) and 60 W
3. Volleyball captions on changeable panels
4. Advantage time option for wrestling mode – PLAYER and FOUL digits reversed
5. Hinged metal mesh protective screen – painted to match scoreboard

2.04 SCORING CONSOLE

A. Console is an All Sport® 5000 controller
B. Scores multiple sports using changeable keyboard inserts
C. Controls multiple scoreboards, stats displays and shot clocks, including other All Sport 5000 controlled displays currently owned by customer
D. Recalls clock, score, and period information if power is lost
E. Runs Time of Day and Segment Timer modes
F. Console includes:
1. Rugged aluminum enclosure to house electronics
2. Sealed membrane water-resistant keyboard
3. 32-character backlit LCD to verify entries and recall information currently displayed
4. Power cord that plugs into a standard grounded outlet; 6 watts max
5. Control cable to connect to the control receptacle junction box (wired system only)
6. Hand-held switch for main clock start/stop and horn
7. Soft-sided carrying case

G. Accessory Equipment
1. 2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the scoreboard(s)
2. Hard carrying case

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that mounting surface is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings.

3.02 INSTALLATION

A. Power conduit, cables and outlet boxes to be provided and installed by the electrical contractor. Signal raceways, conduit and boxes to be provided by the electrical contractor. Electrical contractor is also responsible for any required wire and terminators between each scoreboard and control location.
B. Mount scoreboards and interior displays to wall in location detailed and in accordance with manufacturer's instructions. Unit to be plumb and level.

3.03 INSTALLATION—CONTROL CENTER

A. Provide boxes, cover plates and jacks as required to meet control specification requirements. Control cables to control panels shall be concealed.

B. Test the operation of the scoreboard, controller and all control jacks; leave control unit in carrying case and other loose items with owner's designated representative.
C. Conduct operator training on the scoreboard/controller operation.

END OF SECTION 116643

SECTION 116653
GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fold-up divider systems.
2. Electric operators.
3. Divider curtains.
4. Divider system accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium dividers.

1. Include plans showing alignment of curtains in relation to sport-court layout and overhead structural supports.
2. Include elevations, sections, details, and attachments to other work.
3. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
4. Include point loads and locations for attachment of gymnasium dividers to structure.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For divider curtain fabrics, not less than 12 inches square of white mesh and of gray solid fabric.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans with divider-curtain layouts, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which divider-curtain systems will be attached.
2. Suspended ceiling components, if any.
3. Items supported from building structure, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Smoke detectors.
f. Acoustical treatments or panels.
g. Access panels.

B. Qualification Data: For Installer.

C. Sample Warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium dividers to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience under current organizational structure.
1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 WARRANTY

A. Standard Warranty: Furnish manufacturer's standard 5 year warranty providing coverage against failures in materials or workmanship.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gymnasium dividers.
b. Tearing or deterioration of fabric, seams, or other materials beyond normal use.

PART 2 - PRODUCTS

2.1 MANUFACURERS

A. Basis of Design Manufacturer: Draper or comparable products by one of the following:

1. AALCO Manufacturing.
2. ADP Lemco.
3. Jaypro Sports, LLC.
4. Performance Sports Systems.
5. Porter Athletic Equipment Co.
6. Comparable products by other manufacturers will be considered.

2.2 FOLD-UP DIVIDER SYSTEMS

A. Divider-Curtain System: Electrically operated, upward folding, cable suspended, and as follows:

1. Top Hem: Double-thickness mesh or solid vinyl for continuous pipe batten.
2. Outer Edge Hems: Triple turned and welded.
3. Bottom Curtain Pocket: 6 inches with manufacturer's standard pipe batten with padding.
4. Grommets: Manufacturer's standard material, size, and spacing; for lift cables to pass through curtain fabric.
5. Support Cables: 1/8-inch- diameter galvanized-stranded-steel wire rope with a breaking strength of 2000 lb. Provide fittings according to cable manufacturer's written instructions for size, type, number, and installation method.
6. Support Chain and Fittings: Hardened alloy-steel chain rated for lifting loads indicated, with commercial-quality, corrosion-resistant steel connectors and hangers.
7. Curtain Battens and Drive Pipe: Fabricate from steel pipe or tubing with a minimum number of joints, as necessary for required lengths. Provide galvanized battens and drive pipe, or shop prime and shop finish with black paint.

    a. Drive Pipe: 2-3/8-inch-nominal diameter steel pipe.
    b. Top and Bottom Battens: 1-1/2-inch-nominal diameter steel pipe.

2.3 ELECTRIC OPERATORS

A. Provide factory-assembled electric operation system of size and capacity recommended in writing and provided by gymnasium divider manufacturer for gymnasium dividers specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.

1. Include wiring from control stations to motors and between synchronizer and dual motors for long curtains. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

2. Basis of Design Product: C129.030 by Draper Inc. or comparable product.

B. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Motor Electrical Characteristics:

1. Horsepower: 3/4 hp.
2. Voltage: 115 V ac, single phase, 60 hertz.

D. Limit Switches: Adjustable switches at each divider curtain, interlocked with motor controls and set to automatically stop divider curtain at fully extended and fully retracted positions.

E. Control System:

1. Key-Switch Operation: NEMA ICS 6, Type 1 enclosure, momentary-contact, three-position switch-operated control with up, down, and off functions.

a. Group Key-Switch Control: One switch per each curtain
b. Switches, Ganged: Single faceplate with multiple switch cutouts for all motor switches.
c. Keys: Provide two keys per station.

2.4 DIVIDER CURTAINS

A. Upper Curtain, Mesh: Woven mesh of polyester yarn coated with vinyl, weighing not less than 7 oz./sq. yd.

1. Mesh Color: White.

B. Lower Curtain, Solid: Woven polyester fabric coated with vinyl, 18 oz./sq. yd.

1. Fabric Colors: Gray.

C. Outer Edge Hems: Folded and electronically welded.

D. Seams: Horizontal and electronically welded.

E. Overall Curtain Height: Floor to track, within installation clearances required.

F. Bottom of Curtain: Approximately 2 inches above finished floor.

G. Divider-Curtain Flame-Resistance Rating: Passes NFPA 701 Test 2.

2.5 DIVIDER SYSTEM ACCESSORIES

A. Safety Lock: Locks drive system when speed exceeds manufacturer's recommended speed.
1. Basis of Design Product: 504321 by Draper Inc. or comparable product.

B. Audible Motion Alarm: Provide alarm with intermittent warning tone when curtain is raised or lowered.
1. Basis of Design Product: 503065 by Draper Inc. or comparable product.

2.6 SUPPORT MATERIALS AND FASTENERS

A. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80, heat-treated alloy-steel chains, according to ASTM A391/A391M, with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and hangers.

B. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A413/A413M, Grade 30 proof coil chain or higher grade recommended by gymnasium divider manufacturer. Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.

C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Install gymnasium dividers after other finishing operations, including painting, have been completed unless otherwise indicated.

C. Install gymnasium dividers level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with sport-court layout.

1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.

D. Electric Operators Installation: Connect electric operators to building electrical system.

3.3 ADJUSTING

A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, uneven tension, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.4 CLOSEOUT ACTIVITIES

A. DEMONSTRATION
1. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium dividers.

END OF SECTION 116653

SECTION 116800
PLAYGROUND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

B. Related Sections:

1. Section 03 3000 Cast In Place Concrete
2. Section 31 3220 Geotextile Fabric
3. Section 32 9410 Engineered Wood Fiber
4. Section 33 4605 Subdrainage Systems

1.2 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials and concrete foundations, to provide the Owner with complete and satisfactory playground equipment. These playgrounds shall be completed and ready for operation and shall include all items necessary for the proper use of the system, whether incorporated in this specification or not.

1.3 QUALITY ASSURANCE

A. Manufacturer’s warranty shall apply for all play equipment.

B. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

C. Installer Qualifications: Minimum 2 year experience installing similar products.

D. All furnished installations shall be certified and validated to be in conformance with the ASTM F1487 Standard.

E. To the best of manufacturer's belief and knowledge play structures conform to the U.S. Consumer Products Safety Commission (CPSC) Guidelines.

F. Unless otherwise noted, all play structures are considered accessible according to the current ADA Standard for Accessible Design.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

B. Shop Drawings.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Installation Documentation: All shipments shall include a packet of order-specific, step-by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, and area required information.

E. Sample Manufacturer’s warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Packaging: Components shall be individually wrapped or bulk wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. The components and crates are then shrink-wrapped to skids (pallets) to ensure secure shipping.

C. Handling: Handle materials to avoid damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 PLAYGROUND MANUFACTURERS

A. The following are acceptable playground equipment manufacturers.

1.	Burke Company, LLC	800-356-2070
2.	GameTime	800-444-4654
3.	Penchura - Landscape Structures, Inc.	517-505-8360
4.	We Build Fun - Miracle	972-727-0653

B. Equipment shall be appropriate for 5-12 year old children, ASD and EI
C. Colors: To be determined by Owner
D. The following is the **minimum** basis of design for playground equipment to be installed and shall be an **approved equal**.
E. Quantities Identified on drawings

2.2 PLAYGROUND EQUIPMENT – AREA 1

ITEM DESCRIPTION
5” Post, Arch Frame 8’ high Swings, 4-bay w/ Kick Mats (36” x 60” x 2”) and Belt Seats. Molded Plastic Safety Seats at Qty: 1
Glass Fiber Reinforced Concrete Climber Linked with Net Climber, 4’-6’ fall height. Basis of Design: Landscape Structures Inc. AdventureScapes Design 2
Composite linked Balance Climber. Basis of Design: Landscape Structures Inc. Forma Folio Balance Climber Landscape Structures Inc. Forma Footprint Balance Beam Landscape Structures Inc. Forma Footprint Stepper 8” Landscape Structures Inc. Forma Footprint Stepper 16”
Nature Themed Play Structure w/ Recycled Wood-Grain User Capacity: 40 ADA Accessible Entrance Ramp from existing pavement 5” Post Assembly 72” Slide - Qty: 2 Climbers - Qty: 3 Brachiating Overhead Linking Event (Approx Height: 4’) – Qty: 1 Panels - ADA Accessible, ASD, and EI focus - Qty: 6 Balance Activities - Qty: 2

2.3 PLAYGROUND EQUIPMENT – AREA 2

ITEM DESCRIPTION
Group Swing- Basis of Design: Landscape Structures Inc. Double Oodle Swing w/ Kick Mats (60” x 60” x 2”)
Glass Fiber Reinforced Concrete Pod Hoppers. Basis of Design: Landscape Structures Inc. Mushroom Steppers
Glass Fiber Reinforced Concrete Climber. Basis of Design: Landscape Structures Inc. Log Crawl Tunnel
Glass Fiber Reinforced Concrete Composite linked Balance. Basis of Design: Landscape Structures Inc. Peak Rock Climber Landscape Structures Inc. Log Bench Landscape Structures Inc. Log Stepper
Nature Themed Play Structure w/ Recycled Wood-Grain User Capacity: 25 ADA Accessible Entrance Ramp from existing pavement 5” Post Assembly 72” Slide - Qty: 1 48” Slide - Qty: 1 Climbers - Qty: 2 Panels - ADA Accessible, ASD, and EI focus - Qty: 4 Balance Activities - Qty: 2
Log Hoppers 8”-14” diameter, varying heights 6”-14” in increments of 2”

2.4 PLAYGROUND EQUIPMENT – GaGa Ball

ITEM DESCRIPTION

Basis of Design: General Recreation, Inc. GaGa Flooring Kit for 20’ GaGa Ball Pit 5/8" thick dome interlocking recycled rubber mat tiles (24” x 24”min)
Basis of Design: Landscape Structures Inc. TuffTimbers High-density polyethylene with UV stabilizer added 4' x 12" x 4" border planks with 48"-long galvanized steel stakes

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as per manufacturer’s installation instructions.

3.2 GENERAL CLEAN-UP AND DISPOSAL

A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area clean and in a condition acceptable by the Landscape Architect and Lansing School District. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 116800

SECTION 118129
HORIZONTAL FALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fall Protection Horizontal Cable Systems
      a. Rooftop cable. (DBI-SALA RoofSafe Anchor and Cable System)

B. Related Sections:

   1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   3. Section 077100 "Roof Specialties" for manufactured fascia, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

   1. ANSI A10.32 - Personal Fall Protection Used in Construction and Demolition Operations.
   2. ANSI Z359.1 - Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components.
   3. ANSI Z359.6 - Specifications and Design Requirements for Active Fall Protections Systems.

B. ASTM International (ASTM):

   1. ASTM A123 / A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A747/A747M - Standard Specification for Steel Castings, Stainless, Precipitation Hardening.
3. ASTM A36 - Standard Specification for Carbon Structural Steel.
4. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
5. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. American Welding Society (AWS):

1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. CSA Group (CSA):

1. CSA Z259.16 - Design of Active Fall Protection Systems.
2. CSA W55.3 - Certification of companies for resistance welding of steel and aluminum.
3. CSA W59 - Welded steel Construction.

E. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 CFR 1926.502 - Fall Prevention Systems and Criteria and Practices.
2. OSHA 29 CFR 1910.29 General Industry.

1.4 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data and product information indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing in sufficient detail that the product complies with the contract requirements.

B. Shop Drawings: For fabrication showing the complete fall protection system. Layout drawings of each system in relation to the supporting structure indicating the locations of properly labeled components.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Installer's Certification: Furnish proof of installer's current certification approval by manufacturer in the form of the installer's current certificate issued by the manufacture.

D. Product Certificate: Containing the manufacturer's batch number on each individual component used in the systems.

E. Qualifications Statement: For engineer performing delegated design.

F. Systems Manual:

1. Maintenance Procedures: Including parts list and maintenance requirements for all equipment.
2. Operation Procedures: Indicating proper use of equipment for safe operation of the systems.
3. Manufacturer's catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing sufficient detail that the product complies with the contract requirements.

G. Record Documents: Include a copy of Record Drawings in the systems manual.

H. Warranty: Submit manufacturer warranty.

I. Delegated-Design Submittal: For fall protection system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 25-year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2-year experience installing similar products, authorized, trained, and certified by manufacturer.

C. Engineer for Delegated Design: Licensed in the jurisdiction and with a minimum of two years engineering fall protection systems.

D. Coordination: Coordinate the installation of horizontal fall protection system with structural supports and finish materials.

1.7 WARRANTY

A. Manufacturer's 10-year minimum corrosion resistance and product warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: 3M Fall Protection Business, which is located at: 3833 Sala Way; Red Wing, MN 55066-5005; Toll Free Tel: 800-328-6146; Tel: 651-388-8282; Fax: 651-732-9244; Email: request info (3Mfallprotectionbusiness@mmm.com); Web:https://www.3m.com/3M/en_US/p/c/ppe/fall-protection/i/safety/personal-safety/

B. Diversified Fall Protection

C. Guardian Fall Protection.

D. Comparable products by other manufacturers will be considered.

E. Source Limitation: Obtain fall protection system and components from a single manufacturer.

2.2 FALL PROTECTION CABLE SYSTEMS; FORCE MANAGEMENT ROOF ANCHOR AND CABLE

A. Basis of Design: DBI-SALA RoofSafe Anchor and Cable System as manufactured by 3M Fall protection. Rooftop horizontal cable fall protection system for rooftop maintenance including end anchors, intermediate cable supports, variable cable supports, traveler and corner cable supports as required.

1. Maximum span of 50 feet (15 m) between anchors and provides continuous hands free access for the user of the roof fall protection system.
2. Allow for multiple users, based on required system calculations.
3. Simultaneous Users: Up to 4 per sub span based on system design.
4. System shall not be used as a tieback anchor for facade maintenance.

B. Performance Requirements:

1. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 - Quality Requirements.
2. Structural Performance: Fall protection systems shall withstand the effects of loads and stresses within limits and under conditions required by:
   a. CSA Z259.16.
   b. ANSI Z359.6
   c. OSHA 1926.502.
   d. Allow for multiple users, based on required system calculations.
   e. Simultaneous Users: Up to 4 per sub span based on system design.
   f. System capable of spanning 50 feet (15 m) between intermediate supports.
   g. Allowable Force on Structure: 1,686 lbs. (7.5 kN) maximum.

C. Components:

1. Cable: 7x7, 5/16-inch (8 mm) 316 Stainless Steel Wire, Breaking Strength 8,542 lbs. (38 kN) minimum.
2. End Anchorage Connector: 316 Stainless Steel, electro-polished and Lot Numbered.
3. Tensioner: 180 lbs. (0.8 kN) 316 Stainless Steel.
4. Dampener: 180 lbs. (0.8 kN) 316 Stainless Steel with thermal cyclic loading.
5. Intermediate Guide: 316 Stainless Steel, electro-polished.
6. 90 and 45 Degree Corners: 316 Stainless Steel, electro-polished. Other angles are achieved using Variable Guide, spot welded.
7. Variable Guide: 316 Stainless Steel, electro-polished, spot welded.
8. Swage Toggles: 316 Stainless Steel, electro-polished.

9. Detachable Traveller: 8 mm. ASTM A747/A747M Precipitation Hardening Stainless Steel Casting, electro-polished and numbered. Double Locking for installation and removal, compatible D-ring for use with Snaphook in accordance to ANSI Z359.1.
10. Finish type for modular end, corner, and intermediate anchors:
    a. Anchorage Baseplates: Anodized aluminum plates designed and tested to be used with modular end, corner, and intermediate anchors.

D. Materials:
1. Primary Cable Assembly Components: Stainless steel, ASTM A666, Type 316.
2. Aluminum: 6061 aluminum alloy.
3. Aluminum: 6082 aluminum alloy.

E. Fabricated Supports:
1. Carbon steel with corrosion resistant finish. Steel Plates, Shapes.
2. Bars: ASTM A36 Steel Tubing: ASTM A500, cold formed.
3. Welding rods and bare electrodes: Select according to AWS specifications or metal alloy welded.

F. Connectors:
1. Comply With:
    a. OSHA regulation 1926.502.
    b. ANSI Z359.1.
    c. CSA Z259.12-11.

G. Fabrication:
1. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.
2. Shop fabricate required anchorage posts using structural steel with material test certificates for full material traceability.

H. Welding
1. AWS structural specification D1.1 by certified welders.
2. Fabricate joints in a manner to discourage water accumulation.

I. Finishes:
1. Stainless Steel: Electropolished for corrosion resistance.
2. Structural Steel: Zinc Galvanized for corrosion resistance.
3. Aluminum: Anodized.
4. Aluminum: PVC coated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install according to approved shop drawings and manufacturer's instructions. Coordinate with work of other trades.

B. Install anchorage and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.

C. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges. Coordinate anchorage system with supporting structure.

D. Do not load or stress system until materials and fasteners are properly installed and ready for service.

3.3 FIELD QUALITY CONTROL

A. Provide manufacturer's certified installer to inspect installed fall protection system. Ensure that system components operate as specified.

3.4 REPAIR AND CLEANING

A. Adjust fall protection components to function smoothly and safely.

B. Clean the systems metal components with a soft brush, warm water, and a mild soap solution if needed after initial installation.

C. Ensure all components are thoroughly rinsed with clean water after cleaning.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Provide training at the lifeline installation site.
   4. Training to take place at the completion of the installation.

END OF SECTION 077200

SECTION 122413
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with dual rollers.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Creative Windows of Ann Arbor.
2. Draper Inc.
3. Hunter Douglas Contract.
4. Levolor.
5. Lutron Electronics Co., Inc.
6. MechoShade Systems, Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard .
    a. Loop Length: Full length of roller shade .
    b. Limit Stops: Provide upper and lower ball stops.
    c. Chain-Retainer Type: Clip, jamb mount .

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings .
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller .
3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube .

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric .
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    a. Type: Enclosed in sealed pocket of shadeband material .

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    a. Shape: L-shaped .
    b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches .
2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range .

2.3 MOTOR-OPERATED, DUAL-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CREATIVE WINDOWS OF ANN ARBOR.
2. Draper Inc.
3. Hunter Douglas Contract.
4. Lutron Electronics Co., Inc.
5. MechoShade Systems, Inc.

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated,

complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
   a. Electrical Characteristics: 120V AC, 60 hz .
   b. Maximum Total Shade Width: As required to operate roller shades indicated .
      1) Shade breaks only at vertical mullions
   c. Maximum Shade Drop: As required to operate roller shades indicated .
   d. Maximum Weight Capacity: As required to operate roller shades indicated .
3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following for remote-control activation of shades:
   a. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
   b. Color: As selected by Architect from manufacturer's full range .
4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
6. Operating Features:
   a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
   b. Capable of interface with audiovisual control system.
   c. Capable of accepting input from building automation control system.
   d. Override switch.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Double-Roller Mounting Configuration: Offset, outside shade over and inside shade under.
2. Inside Roller:
   a. Drive-End Location: As indicated on Drawings .
   b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller .
3. Outside Roller:
   a. Drive-End Location: As indicated on Drawings .
   b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller .
4. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube .

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

A. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

B. Inside Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: as scheduled

C. Outside Shadebands:

1. Shadeband Material: Light-blocking fabric as scheduled .
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: as scheduled

D. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped .
   b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.
2. Exposed Headbox: (Outside mount) Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
   a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.
   b. Endcap Covers: To cover exposed endcaps.
3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range .

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 . Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer .
2. Type: Woven PVC-coated fiberglass and PVC-coated polyester .
3. Weave: Basketweave .
4. Thickness: 0.035 inches .
5. Weight: 13.5 oz/yd2 .
6. Roll Width: Manufacturer's Standard .
7. Orientation on Shadeband: Railroaded .
8. Openness Factor: 3 percent.
9. Color: As selected by Architect from manufacturer's full range .

C. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer .
2. Type: Woven PVC-coated fiberglass and PVC-coated polyester .

3. Weave: Basketweave .
4. Thickness: 0.035 inches .
5. Weight: 13.5 oz/yd2 .
6. Roll Width: Manufacturer's Standard .
7. Orientation on Shadeband: Railroaded .
8. Openness Factor: Blackout
9. Color: As selected by Architect from manufacturer's full range .

2.5 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 , provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. INSTALL ALL ACCESSORIES AND WALL CLIP

C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

D. Roller Shade Locations: As indicated on Drawings .

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.6 SHADE SCHEDULE – LOCATED ON EQUIPMENT DETAILS SHEET

END OF SECTION 122413

SECTION 123000
MANUFACTURED PLASTIC-LAMINATE-CLAD MUSIC CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad music casework – **Class A Rating**
2. Casework hardware and accessories.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
3. Section 096513 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-clad casework.
4. Section 123216 "Plastic-Laminate Clad casework"
5. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.2 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework with Kingscott tag information from schedule.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.

C. Samples for Verification: For the following:

1. Plastic Laminates: Chip - Size , for each type, color, pattern, and surface finish required.
   a. Provide one Sample applied to core material with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For casework manufacturer and Installer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: certificates.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer .

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

E. Protect casework from exposure due to other trades from damage. Contractor shall document final installation for project closeout review.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Delamination of components or other failures of glue bond.
   b. Warping of components.
   c. Failure of operating hardware.
2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wenger Corporation: UltraStor Storage Cabinets
2. Case Systems Inc; Equal
3. TMI Systems Design Corporation; Equal

B. Source Limitations: Obtain from single source from single manufacturer.

2.2 GENERAL REQUIREMENTS FOR CASEWORK

A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium .
2. Provide labels and certificates from AWI certification program indicating that casework complies with requirements of grades specified.
   a. Contractor shall register the Work under this Section with AWI's Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

B. Product Designations:

1. Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-clad casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."
2. Drawings indicate configurations of manufactured plastic-laminate-clad casework by referencing designations of Casework Design Series numbering system in the Appendix of the AWI/AWMAC/WI's "Architectural Woodwork Standards."

2.3 PLASTIC-LAMINATE-CLAD CASEWORK

A. Design: Frameless cabinet construction with the following door and drawer-front style:

1. Flush overlay.

B. Grain Direction for Wood-Grain Plastic Laminate:

1. Doors: Vertical with continuous vertical matching.
2. Face Frame Members: Lengthwise.
3. End Panels: Vertical.
4. Bottoms and Tops of Units: Side to side.

C. Exposed Materials:

1. Plastic-Laminate Grade: HGS .
   a. Colors and Patterns: See Schedule at end of Part 3.

D. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.
   a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
2. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E. Concealed Materials:

1. Plastic Laminate: Grade BKL.

2.4 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish powder-coated, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Powder-coated, semiconcealed, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Wire Pulls: Solid aluminum wire pulls, fastened from back with two screws.

1. Provide two pulls for drawers more than 24 inches wide.

D. Door Catches: , nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.

E. Hinged-Door Locks: 0.105 inch (2.67 mm) min. thickness steel, with padlock eye, powder-coat finish, through-bolted to panel door and side panel and welded to grille door frames. Latches securely without padlock. Provide with clear plastic label holder for use with standard size labels; number system available for user to print. Padlocks furnished by Owner.

2.5 MATERIALS

A. Fire Rated Particleboard: ANSI A208.1, minimum 45 lb/cu ft. density ASTM E-84, Class 1.

B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

C. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors fronts, 1.0 mm thick elsewhere.

D. Polyethylene Shelves: High-density, one-piece, blow molded or polyethylene with radiused front edge for abuse-resistant shelves. Same color throughout.

E. Fasteners: Manufacturer-recommended fasteners as required for casework substrate and project performance requirements, consisting of one or more of the following:

1. Sheet Metal Screws: SAE J78, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
2. Wood Screws: ASME B18.6.1.
3. Expansion Anchors in Concrete and Concrete Masonry Units: Carbon-steel, zinc plated.
4. Hardware supplied to anchor the cabinets to the wall and to adjacent casework.

2.6 FABRICATION

A. Plastic-Laminate-Clad Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. General: Provide through-ventilation instrument storage casework.
2. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch Fire-Rated particleboard.
3. Shelves: Sized with adequate gap between shelving and casework side panels to allow air movement inside casework.
   a. Up to 27 inches wide: Removeable molded polyethylene shelf, with impact-resistant, radiused front edge, mounted to cabinet wall with self-locking clip.
   b. Over 27 inches wide: For large instrument casework: Removeable formed polyethylene shelf, ribbed, with high-impact-resistant, radiused front edge, supported by steel tube frame.
   c. Tubular steel supports for shelves over 19 inches wide.

4. Backs Panel: 7/32 inch reinforced with ¾ inch stretchers panels held in a dado groove and lag screwed in place.
5. Panel connectors: 1/4—20 by 1.77 inch panel connectors, with steel thread inserts, power coated to match panels.
6. Cabinet levelers: Leveling glides with 3/8 inch diameter threaded steel rod in steel corner brackets, minimum two each per cabinet side, accessible from withing unit, and concealed in completed installation.

B. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Grade: Install casework to comply with same quality standard grade as item to be installed.

B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

F. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

3.4 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.5 LAMINATE SCHEDULE

A. **PLAM-1**: Plastic Laminate (GP28) (**All Vertical surfaces U.N.O**).
1. Manufacturer: WILSONART
2. Color: LANDMARK WOOD
3. Finish: 7981K-28
4. Edge Color: REHAU EDGEBAND TO MATCH

SCHEDULE FOLLOWS:

*MANUF. LISTED HERE ARE FOR REFERENCE ONLY. REFER TO SPECIFICATION FOR APPROVED BIDDERS.
*NOT ALL CABINETS LISTD HERE ARE SPECIFIED IN PROJECT. REFER TO EQUIPMENT PLANS.

MUSIC

84" MUSIC CABINET

(for music casework only- individual doors per compart.)

GRILL CABINETS

TAG #	LSI STYLE #	TMI STYLE #	CASE STYLE#	WENGER STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
MS-3	8201	M5000	1620MOD	2	27"	30"	84"	Tall cabinet. 15 doors hinged left, 2 vertical dividers, 4 fixed shelves, 15 instrument compartments. Compartment size: 8" x 27"x 14.5"	Locking
MS-9	8221	M5004	1620MOD	5	27"	40"	84"	Tall cabinet. 10 doors hinged left, 1 vertical divider, 4 fixed shelves, 10 instrument compartments. Compartment size: 12" x 37" x 14.5"	Locking
MS-10	8225	M5004R	1620MOD	5	27"	40"	84"	Tall cabinet. 10 doors hinged right, 1 vertical divider, 4 fixed shelves, 10 instrument compartments. Compartment size: 12" x 37" x 14.5"	Locking
MS-19	8261	M5024	1640	10	27"	30"	84"	Tall cabinet. 3 doors hinged left, 3 compartment size: 25.5" x 27.5" x 25"	Locking
MS-22	8265	M5024R	1640	11	27"	40"	84"	Tall cabinet. 3 doors hinged right, 3 compartment size: 25.5" x 37.5" x 25"	Locking

TAG #	LSI STYLE #	TMI STYLE #	CASE STYLE#	WENGER STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
MS-23	8421	M3028		12	48"	30"	84"	Tall cabinet. 2 doors, 3 shelves. Compartment size: 46.5" x 29" x 25"	Locking
MS-28	8281	M5032		14	27"	40"	84"	Tall cabinet. 2 doors hinged left, 2 compartment size: 25.5" x 37.5" x 38"	Locking
MS-102	8206	M5000R		1	27"	20"	84"	Tall cabinet. 1 door hinged right, 2 vertical dividers, 4 fixed shelves, 15 instrument compartments. Compartment size: 8" x 17"x 14.5"	Locking

SECTION 123216
MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad casework.
2. Casework hardware and accessories.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring casework.

2. Section 062023 “Interior Finish Carpentry” for paneling and interior trim locations.
3. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
4. Section 096513 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-clad casework.
5. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.3 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer – demonstration of 5 years related experience on projects of similar size and scope.

B. Sample Warranty: For special warranty.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range

recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Case Systems, Inc.
2. Stevens Industries, Inc.
3. TMI Systems Design Corporation
4. Flairwood Industries.
5. Architects pre-approved equal.

B. Source Limitations: Obtain all standard plastic laminate casework from single source from single manufacturer.

2.2 GENERAL REQUIREMENTS FOR CASEWORK

A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium.

B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-clad casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."

C. Product Designations: Drawings indicate configurations of manufactured plastic-laminate-clad casework by referencing designations of Casework Design Series numbering system in the Appendix of the AWI/AWMAC/WI's "Architectural Woodwork Standards."

2.3 PLASTIC-LAMINATE-CLAD CASEWORK

A. Design: Frameless cabinet construction with the following door and drawer-front style:
1. Flush overlay.

B. Grain Direction for Wood-Grain Plastic Laminate:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: Vertical with continuous vertical matching.
3. Face Frame Members: Lengthwise.
4. End Panels: Vertical.
5. Bottoms and Tops of Units: Side to side.
6. Knee Space Panels: Vertical.
7. Aprons: Horizontal.

C. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.

   a. Colors and Patterns: As selected by Architect from manufacturer's full range.
   b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
3. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.
4. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

D. Concealed Materials:
1. Plastic Laminate: Grade BKL.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Powder-coated, semiconcealed, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Wire Pulls: Solid brushed aluminum wire pulls, fastened from back with two screws.
1. Provide two pulls for drawers more than 24 inches wide.

D. Door Catches: Powder-coated. Provide two catches on doors more than 48 inches high.

E. Provide chain door stops at tall cabinets.

F. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

G. Drawer Slides: ANSI/BHMA A156.9, Type B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.

H. Drawer and Hinged-Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per lock and six master keys.
2. Provide locks on every door and drawer except sink base.
3. Rooms keyed alike per room and master keyed.

I. Adjustable Shelf Supports: Two-pin-locking plastic shelf rests complying with ANSI/BHMA A156.9, Type B04013.

2.5 MATERIALS

A. Composite Wood Products: Products shall be made without urea formaldehyde.

B. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

C. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

D. Particleboard: ANSI A208.1, Grade M-2.

E. Hardboard: ANSI A135.4, Class 1 tempered.

F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

G. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

H. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.6 FABRICATION

A. Plastic-Laminate-Clad Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
2. Shelves: 3/4-inch-thick plywood or 1-inch- (25-mm-) thick particleboard.
3. Backs of Casework: 1/2-inch-thick particleboard or MDF where exposed, 1/4-inch-thick hardboard dadoed into sides, bottoms, and tops where not exposed.
4. Drawer Fronts: 3/4-inch particleboard.
5. Drawer Sides and Backs: 1/2-inch-thick MDF, with glued dovetail or multiple-dowel joints.
6. Drawer Bottoms: 1/4-inch MDF glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 24 inches wide.
7. Doors 48 Inches High or Less: 3/4 inch thick, with particleboard or MDF cores and solid-wood stiles and rails.
8. Doors More Than 48 Inches High: 1-1/8 inches (29 mm) thick, with particleboard cores.

B. Mobile Cabinets:
1. Mobile backs: 1 inch thick core.
2. Maximum load rating: 500 pounds.
3. Construction:
   a. Core: 3/4 inch thick.
   b. Core platform: 1 inch thick.
   c. Edging for platform and mobile tops: 3 mm thick.
   d. Mobile tops:
   e. Overhang at front, sides and rear.

C. Sloped Tops: Separate unit from cabinet, set at 30-degree angle.

D. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.
1. Provide top and bottom fillers at tall and wall cabinets to match cabinet exterior.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Grade: Install casework to comply with same quality standard grade as item to be installed.

B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.4 LAMINATE SCHEDULE

A. **PLAM-1**: Plastic Laminate (GP28) (**All Vertical surfaces U.N.O**).

1. Manufacturer: WILSONART
2. Color: LANDMARK WOOD
3. Finish: 7981K-28
4. Edge Color: REHAU EDGEBAND TO MATCH

B. PLAM-2~~1~~: Plastic Laminate (GP28) (All Vertical surfaces U.N.O).

1. Manufacturer: WILSONART
2. Color: Indigo
3. Finish: D379-60
4. Edge Color: REHAU EDGEBAND TO MATCH

3.5 SCHEDULE FOLLOWS

***MANUF. LISTED HERE ARE FOR REFERENCE ONLY. REFER TO SPECIFICATION FOR APPROVED BIDDERS.**
***NOT ALL CABINETS LISTED HERE ARE SPECIFIED IN PROJECT. REFER TO EQUIPMENT PLANS.**
***PROVIDE PLASTIC LAMINATE COUNTERTOP AT ALL BASE CABINETS, U.N.O.**

TAG #	TMI STYLE #	CASE STYLE#	STEVENS STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
							34" DRAWER - DOOR BASE CABINETS	Locking of cabinets is typical unless noted otherwise (UNO)
B-3			10432	36"	24"	34"	Drawer, door base cabinet. 2 hinged doors, 2 drawers, 1 adjustable shelf	Locking
B-11			10425	18"	24"	34"	Drawer, door base cabinet. 1 door hinged right, 1 drawer, 1 adjustable shelf	Locking
							34" DRAWER - DOOR BASE COMBINATION CABINETS	
B-43			10129	36"	24"	34"	Door base cabinet. 2 hinged doors, 1 adjustable shelf	Locking
B-44			10129	30"	24"	34"	Door base cabinet. 2 hinged doors, 1 adjustable shelf	Locking
B-45			10129	24"	24"	34"	Door base cabinet. 2 hinged doors, 1 adjustable shelf	Locking

TAG #	TMI STYLE #	CASE STYLE#	STEVENS STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
							34" DRAWER BASE CABINETS	
B-61			10371 Mod.	36"	24"	34"	Drawer base. 4 drawers equal size OR 4" top drawer , 3 bottom drawers equal	Locking
B-62			10371 Mod.	30"	24"	34"	Drawer base. 4 drawers equal size OR 4" top drawer , 3 bottom drawers equal	Locking
B-64			10370	18"	24"	34"	Drawer base. 4 drawers equal size OR 4" top drawer , 3 bottom drawers equal	Locking
B-82			10479	42"	24"	34"	Sink base. Blank panel, 2 hinged doors.	
B-91				48"	24"	34"	Sink base. 2 hinged doors. No toe base. Pocket door hardware- Accuride ProPocket	Floor finish and wall base shall be installed at cabinet interior
B-92				42"	24"	34"	Sink base. 2 hinged doors. No toe base. Pocket door hardware- Accuride ProPocket	Floor finish and wall base shall be installed at cabinet interior
B-113			10316	18"	24"	34"	Drawer base, 2 Equal Drawers (File/ File)	

TAG #	TMI STYLE #	CASE STYLE#	STEVENS STYLE #	SIZE WIDTH	SIZE DEPTH	SIZE HEIGHT	DESCRIPTION	Notes
							36" LOW MOBILE UNITS	
B-501			60181	48"	25"	36"	Mobile Closed Storage, Single face, 2 doors, vert. divider, 2 adjustable shelves, Locking casters	Locking
							24" DOOR WALL CABINETS	All Cabinets to have sloped tops with 26816 slope top cover panel, unless noted otherwise
W-3			16129	36"	14"	24"	Wall cabinet. 2 hinged doors, 2 adjustable shelves. Clear inside depth of 12", vertical divider.	Locking
W-202			16129	42"	14"	30"	Wall cabinet. 2 hinged doors, 2 adjustable shelves. Clear inside depth of 12", fixed vertical divider	Locking
W-203			16129	36"	14"	30"	Wall cabinet. 2 hinged doors, 1 adjustable shelf. Clear inside depth of 12".	Locking
W-204			16129	30"	14"	30"	Wall cabinet. 2 hinged doors, 1 adjustable shelf. Clear inside depth of 12".	Locking
W-206			16121	24"	14"	30"	Wall cabinet. 1 door hinged left, 1 adjustable shelf. Clear inside depth of 12".	Locking
W-209			16120	18"	14"	30"	Wall cabinet. 1 door hinged right, 1 adjustable shelf. Clear inside depth of 12".	Locking

TAG #	TMI STYLE #	CASE STYLE#	STEVENS STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
W-804			16149	30"	18"	30"	Microwave wall cabinet. 2 hinged doors above 12"h, open compartment for micro oven 18"h, 18" overall depth	Locking
								All Cabinets to have sloped tops with 26816 slope top cover panel, unless noted otherwise
							TALL STORAGE	
T-11			26129	48"	24"	84"	Tall storage. 2 doors,1 fixed shelf, 4 adjustable shelves, fixed vertical divider.	Locking, Not sloped
T-13			26129	36"	24"	84"	Tall storage. 2 doors, 1 fixed shelf, 4 adjustable shelves.	Locking
T-14			26129	30"	24"	84"	Tall storage. 2 doors, 1 fixed shelf, 4 adjustable shelves.	Locking
T-20			26129 Mod.	36"	**30"**	84"	Tall storage. 2 doors,1 fixed shelf, 4 adjustable shelves	Locking
T-33			26605	36"	24"	84"	Teachers wardrobe cabinet. 2 hinged doors, 1 fixed shelf, 1 clothes rod, 1 vertical divider, mirror, pin tray, 4 adjustable shelves.	Locking
T-134			25542	12"	**15"**	60"	Single student wardrobe. Open front, fixed upper shelf, one ceiling mount double coat hook, countertop above cubbie.	No sloped top
T-155			63273	48"	**18"**	84"	6 lockers	No sloped top

TAG #	TMI STYLE #	CASE STYLE#	STEVENS STYLE #	WIDTH	SIZE DEPTH	HEIGHT	DESCRIPTION	Notes
							MAILBOXES	
MAIL				72"	24"	84"	See detail on sheet A1.9	Sloped top

SECTION 123616
METAL COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless-steel countertops.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded wall-mounted shelves.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal fabrications.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. For countertops, show locations and sizes of cutouts and holes for items installed in metal countertops.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products only after casework and supports on which they will be installed has been completed in installation areas.

B. Keep finished surfaces of products covered with polyethylene film or other protective covering during handling and installation.

1.6 FIELD CONDITIONS

A. Field Measurements: Where products are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where products are indicated to fit to other construction, establish dimensions for areas where products are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 STAINLESS-STEEL FABRICATIONS

A. Countertops: Fabricate from 0.062-inch-thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch over the base cabinets.

1. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.
2. Weld shop-made joints.
3. Sound deaden the undersurface with heavy-build mastic coating.
4. Extend the top down to provide a 1-inch-thick edge with a 1/2-inch return flange.
5. Form the backsplash coved to and integral with top surface, with a 1/2-inch-thick top edge and 1/2-inch return flange.
6. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 .

C. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and the following:

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
2. Color: Clear.

2.2 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Secure countertops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.

D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

E. Seal junctures of countertops, splashes, and walls with sealant for countertops.

3.3 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces. Remove and replace damaged products or touch up and refinish damaged areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123616

SECTION 123661.16
SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Paperstone material countertops (BASE BID)
2. Solid surface material countertops (ADD ALT)
3. Solid surface windowsills.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

B. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 PAPERSTONE COUNTERTOP MATERIALS – **SS-2 (BASE BID)**

A. Paperstone Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Paperstone
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Edge: 1-1/4" EDGE
4. Colors and Patterns: Coverply/ Designer Colors - Pewter

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 SOLID SURFACE COUNTERTOP MATERIALS – **SS-1 (ADD ALT)**

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Durat
   b. Corian
   c. LG Chemical, Ltd.
   d. Wilsonart LLC.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Edge: 1-1/2" STRAIGHT EDGE
4. Colors and Patterns: Standard Collection - 012 White W/ Multi

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.3 SOLID SURFACE WINDOWSILL MATERIALS – **SS-3**

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Durat
   b. Corian
   c. LG Chemical, Ltd.
   d. Wilsonart LLC.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: D354SL- DESIGNER WHITE

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.4 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium

B. Configuration:

1. Front: Straight, slightly eased at top
2. End Splash: Matching backsplash

C. Countertops: 1/4-inch-thick, solid surface material laminated to 3/4-inch-thick particleboard with exposed edges built up with 3/4-inch-thick, solid surface material

D. Backsplashes: 1/2-inch thick, solid surface material

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

F. Joints: Fabricate countertops in sections for joining in field

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
   c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.5 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 127600
GYMNASIUM BLEACHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Telescoping gymnasium bleachers.

1.2 RELATED WORK

A. Section 096566 “Resilient Athletic Flooring”

B. Division 26 – Electrical

1.3 REFERENCES

A. Applicable building code. IBC. Edition Year. 2015, NFPA 2015

1.4 DESCRIPTION OF SYSTEM

A. The bleacher system shall be comprised of multiple tiered, closed deck seating rows operating in a telescopic manner, incorporating the most economical quantity of sections while still complying with all loading requirements.

B. The first moving row shall be secured with friction or mechanical locks. Other rows shall be mechanically locked, operable only upon unlocking and cycling the first row, quantity to be determined by manufacturer.

C. Each bleacher row shall be comprised of risers, seat and deck components, and a complete set of supportive columns and braces.

D. The telescopic bleacher shall incorporate a locking system permitting the use of one, several, or all rows, each locked in the extended position.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturing. The manufacturer shall be regularly engaged in the design and manufacturing of telescopic seating for not less than thirty years.
2. Engineering. It shall be mandatory that each bidder submit with their bid an affidavit signed by a Registered Professional Engineer stating that the product to be supplied has been tested by an independent testing facility and meets all applicable code requirements.

B. Deviations

1. It shall be the responsibility of the bidder to furnish with their bid a list clarifying any and all deviations from these specifications, written or implied. Those bidders not submitting a list of deviations will be presumed to have bid as specified.

C. Warranty

1. 10 year warranty. The manufacturer shall warranty structural components of the understructure for a period of 10 years.
2. 5 year warranty. The manufacturer shall warranty all non-structural materials such as accessories, everything at deck level and above, and all power and electrical components for a period of 5 years.

D. Product Improvements

1. Seating provided shall incorporate manufacturer's design improvements and materials current at time of shipment.

1.6 SUBMITTALS

A. Shop Drawings: Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, material descriptions, finishes, and special conditions. Distinguish between plant- and field-assembled work.

B. Manufacturer's operating and maintenance manuals.

1.7 DESIGN CRITERIA

A. Telescopic bleacher design and fabrication shall conform to IBC 2015 and ADA requirements.

B. Telescopic gymnasium seating will be designed to support a vertical live load of 100 PSF, but not less than 120 PLF on both seat boards and footboards. Seating shall also be designed to carry a horizontal sway force of 24 PLF parallel to the seating and 10 PLF perpendicular to the seating.

C. Steel components shall be cold-formed from appropriate width strip stock conforming to ASTM A570 - Grade C 30KSI, ASTM A653- Grade 33 and 50, ASTM A500 - Grade B 46 KSI as applicable.

D. Lumber components are kiln dried, finger jointed, edge glued southern pine of grade "B & B Finish" manufactured to the current SPIB glued-laminated standards for southern pine.

E. Plywood deck boards shall be fabricated from Douglas Fir Premium Underlayment with exterior glue, 5 ply minimum, solid crossband directly under face ply, species Group 1 and manufactured in accordance with PS-1-95.

1.8 COORDINATION

A. Coordinate layout and installation of bleachers with other gymnasium equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Interkal – Kalamazoo, Michigan

B. Substitution Limitations: All other manufacturers: Submit substitution request prior to bid in accordance with Section 012500 - "Substitution Procedures."

2.2 MATERIAL

A. Model:

1. Basis-of-Design: Interkal, closed deck telescopic bleacher.

B. Type:

1. Wall Attached.

C. Quantity:

1. Provide 1 bank of Wall Attached 4 rows high, 197 Net Seats.

D. ADA:

1. Notchouts. Provide 3'-0 1/4" wide wheelchair spaces as shown on the plans and as required to meet local code jurisdiction compliance with ADA. Notchouts to be 1 row deep.

E. Dimensions:
1. Rise per row: 10.25
2. Row to row spacing: 22

F. Propulsion

1. Friction Power. Furnish Interkal friction power, integral automatic electro-mechanical propulsion system to open and close telescopic seating system. Operation shall assure full visual control of the seating bank. The Wide Track System incorporates two friction drive roller assemblies as an integral part of both first row vertical column assemblies. Each section of bleacher shall have a power system that shall consist of two vertical column roller assemblies which shall include two 6” diameter by 2 ½” wide cast drive wheels for

a minimum of four friction roller contact points per section of bleacher. Each roller shall have a specially formulated 45-durometer rubber covering to grip the floor as the units roll in and out. The two friction drive roller assemblies shall be installed a minimum of 7' apart per section. The two friction roller assemblies are linked together by a continuous drive shaft driven by a 1/2 H.P. 208 volt 3-phase motor that shall enable the rollers to work simultaneously, resulting in a more efficient operation with allowance for minor variations in the floor surface. All floor friction power systems shall be controlled by a dual directional, removable walk along pendant which plugs into the front of the first row to give the operator proper position for visual control. The pendant control voltage shall be 24 VAC @ less than 50 mA for the safety of all operating personnel. The entire power system shall be U.L. Recognized. A 208 volt 3-phase power source, including conduit, wiring, and safety disconnect must be provided by others. The electrical contractor shall perform the connections to the seating equipment at the safety disconnect. Motors, housing, and wiring shall be installed by certified personnel.

2.3 ACCESSORIES

A. Foot level Aisles

1. Provide footrest level aisles at locations and sizes as shown on plans and approved shop drawings.
2. Center Aisle. Provide a permanently attached self-storing aisle rail which is designed to eliminate all labor associated with set up and storage of the aisle rails.
3. Intermediate Steps. Provide manufacturers' standard intermediate step as necessary per applicable code.

B. Wheelchair Seating

1. Recoverable Notchouts. Provide manufacturers' standard recoverable handicap notchouts (3'-0 1/4" wide) located as shown on architectural drawings. Notchouts to be 1 row deep.

C. Self-Storing End Rails

1. Provide steel self-storing 42" high self-storing end guard rails with tubular supports and vertical intermediate members to comply with all code requirements. Rails shall be fitted to each exposed bank end from third row and above with all steel-to-steel connections. Finish shall be a polyester powder coat.

D. Vinyl End Curtains

1. Provide 2 of the manufacturers' standard vinyl end curtains to close off under the bleacher units in the extended position. Curtain color is to be from standard swatch.

2.4 FABRICATION

A. Continuous Wheel Channel

1. Wheel channels shall consist of a one piece formed steel channel welded to the base of a vertical column. Wheel channels accommodate 8 to 12 wheels per row for maximum

weight distribution and operating ease. The number of wheels increases as the number of rows increase.

B. Wheels

1. 3-1/2" diameter with 1-1/8" non-marring soft rubber face with rounded edges designed to protect wood or synthetic floor. Provide 1/2" diameter axle for all wheels.

C. Columns

1. Electrically welded closed rectangular steel tube, 2" x 3" minimum size, 14-guage steel fitted with a rear welded gusset at the wheel channel.

D. Row Interlocks

1. Join each row structure front to rear by means of two (2) interacting steel connections, plus automatic gravity row locks where Engineering determines they are required.
2. Lower track guides shall be an external superslide rod to guarantee positive engagement of vertical supports without binding and assures smooth operation over uneven floor conditions.
3. Upper track guides shall completely interlock adjacent understructure support. A welded stop to ensure correct extension of bleacher unit on deck support. Use of bolt and nut stops is not acceptable, due to the risk of loosening.

E. Digital Braces

1. Structurally formed steel truss fitted to rows 4 and beyond. Bracing shall be attached to the rear riser at optimum locations to ensure structural integrity. Bracing shall be designed and shaped to support a minimum load of 1000 lbs. of both compression and tension forces created when the bleacher is loaded.

F. Deck Supports

1. Shall be of structural steel, 11 gauge spaced not greater than 60" on center for maximum deck stiffness. Every deck support not attached to a vertical post shall have an integral nylon roller to avoid steel to steel friction points for more efficient operation.

G. Decking

1. All deck boards shall consist of 19/32" nominal C-C plugged Group 1 plywood with exterior glue and solid cross bands. Tongue and Groove deck boards are unacceptable. An extruded aluminum "H" connector shall be placed between plywood panels. Exposed wear surfaces shall be finished with a layer of high-Density polyethylene plastic .025 - .030 thick, light gray in color, complimentary to the seat option. Deck finishes, such as clear coat, requiring more than simple touch up to restore it to a new appearance after wear occurs are unacceptable.

H. Welds

1. All welds shall be made at the factory by welders that are AWS certified on the equipment and process used.

I. Nose Beam

1. Shall be one-piece grade 40 galvanized steel. A minimum design thickness of .094” is utilized for the necessary structural integrity to accommodate section lengths up to 26’-0”

J. Rear Riser

1. Shall be one piece formed 14-gauge, grade 40 steel, with a continuous access joint to fully encapsulate footrest panel for ease of cleaning and additional structural support. 14-gauge roll formed steel is utilized for the necessary structural integrity to accommodate section lengths up to 26’-0”

K. Splice Plates

1. Each section joint shall be tied together with two structural steel members per row, employing a minimum of four steel to steel through bolt connections at the nose beam and a minimum of eight steel to steel through bolt connections at the lower steel rear riser. Splice plate material to match the nose beam and rear riser. Splice plates employing steel to plywood deck board attachments will not be acceptable. In order to minimize deflections and keep rows in alignment during operation, splice connections shall transfer both axial loads (tension/compression) and bending.

L. Fasteners

1. All structural connections shall be made with S.A.E. grade 5 or better stress rated bolts. The use of self-tapping bolts is not acceptable.

M. Finish

1. Steel Understructure abraded, cleaned, and finished with russet brown water base acrylic paint. Steel risers and nose beams finished with corrosion resistant silver-gray matte finish with galvanized alloy plating.

2.5 SEAT OPTIONS

A. Excel Seat Modules

1. 18” wide one-piece individual seating modules shall be constructed of solid injection molded high-density polyethylene. Provide in 10" depth.
2. Each module shall have three longitudinal and five transverse internal ribs to provide additional structural integrity and resistance to impact.
3. Each module shall have a full 3/8” interlock to the adjacent module around the perimeter to eliminate pinching hazards and assure proper alignment.
4. Each module shall be equipped with an 11 gauge steel bracket for a steel-to-steel attachment of each module to the galvanized steel nose beam for maximum rigidity. All such mounting hardware shall be concealed.
5. Each module shall have a 2 ¼” x 1” recessed area for optional seat numbering.
6. End caps shall be provided at the ends of each bank (section, if manual) of seating as well as at each aisle.

7. Each end cap shall have two recessed areas including a 3 ½” x 3 ½” area for custom logos and a 2 ¼” x 1” area for optional row letters or numbers.
8. Color: Gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the Following:

1. Verify that areas to receive telescopic bleachers are free from impediments interfering with installation.

2. Do not begin work until building conditions are satisfactory.

3. Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.

3.2 INSTALLATION

A. Install telescopic bleachers in accordance with manufacturer’s instructions and approved submittal drawings.

B. Adjust bleachers for smooth and proper operation.

C. Clean bleachers and remove all debris from gymnasium resulting from installation.

END OF SECTION 127600

SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Above ground piping.

B. Buried piping.

C. Escutcheons.

D. Incoming fire service backflow preventer.

E. Mechanical couplings.

F. Pipe hangers and supports.

G. Pipe sleeves.

H. Pipe sleeve-seal systems.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

D. Section 211200 - Fire-Suppression Standpipes: Standpipe design.

E. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

F. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2018.

H. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

I. ASME B16.25 - Buttwelding Ends; 2022.

J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

L. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

N. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

O. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

P. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

Q. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2017.

R. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

S. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2020.

T. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

V. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

W. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

Y. AWWA C606 - Grooved and Shouldered Joints; 2022.

Z. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AA. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2019, with Amendment.

BB. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems

2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

3. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection

B. Delegated Design: Engage a qualified Fire Protection professional engineer, as defined in Section 014000 "Quality Requirements," to design project sprinkler systems. Base calculations on results of fire-hydrant flow test. Flow test shall be performed within one year of construction start.

C. Hydraulic Design Criteria: Sprinkler system design shall be approved by authorities having jurisdiction, Owner's Insurance Underwriter (where applicable) and shall be designed according to the following:

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers, or 10 psi, whichever is greater.

2. Sprinkler Occupancy Hazard Classifications: Refer to Drawings.

3. Minimum Density for Automatic-Sprinkler Piping Design: Refer to Drawings.

4. Maximum Protection Area per Sprinkler: According to the latest NFPA 13 standard, UL listing and as specified on Drawings.

5. Total Combined Hose-Stream Demand Requirement: According to latest NFPA 13 standard unless otherwise indicated on drawings.

6. Water velocity in the piping system shall not exceed the following:

a. Underground mains: 16 ft/sec.

b. Aboveground mains: 32 ft/sec.

c. Sprinkler branch lines: 20 ft/sec.

7. Water supply noted on the drawings. If not, Contractor shall make flow test to ascertain water flow.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Delegated-Design Submittal: For all sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Shop Drawings and Hydraulic Calculations:

a. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.

b. Indicate installation, layout, weights, mounting and support details, and piping connections.

c. Layout and name (or number) of each room repeated as shown on the Architect's/Engineer's plans.

d. Reflected ceiling plan for each area showing location of partition walls, ceiling grid lines, ceiling light fixtures; proposed location of all fire sprinler heads; and size and location of all piping. Shop drawings shall clearly identify any areas proposed to be protected with "dry type" systems and "anti-freeze type" systems and shall identify sprinkler heads rated for discharge at temperatures other than 165 degrees F.

e. Shop drawings shall be submitted to the Architect/Engineer, AHJ and Owner's Insurance Underwiter (where applicable) for review and approval.

C. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department or pump test header connection.

3. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style number.

D. Shop Drawings, Product Data and Hydraulic calculations shall be reviewed as one package; review of submittals shall not start until Engineer has all product data, hydraulic calculations and shop drawings.

1.6 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Provide fire protection work per the mandatory code requirements, standards of NFPA, and the requirements of the Owner's Insurance Underwriter, where applicable, except where more stringent requirements are indicated, as modified and supplemented by the Contract Documents. The NFPA requirements include the appendices and supplements.

2. The provisions and recommendations of the NFPA constitute mandatory minimum requirements for work specified herein. No payment will be made by the Owner for extra charges for work added in order to comply with NFPA Standards and Owner's Insurance Underwriter requirements, where applicable.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified Fire Protection engineer.

D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

E. Comply with UL (DIR) requirements.

F. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

G. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

H. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3 foot intervals.

I. Fittings: To be identified by manufacturer by permanently attached tags, imprints or other approved means indicating class of wall thickened and material.

1.7 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER

A. Should the Division 21 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design on the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.8 FIELD CONDITIONS - RENOVATION PROJECTS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Architect & Construction Manager no fewer than five days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Architect's and Construction Manager's written permission.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Sprinkler-based System:

1. Comply with NFPA 13.

B. Standpipe and Hose System:

1. Comply with NFPA 14.

C. Combined Sprinkler, Standpipe, and Hose System:

1. Comply with NFPA 13 and NFPA 14.

D. Welding Materials and Procedures: Comply with ASME BPVC-IX.

E. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A135/A135M Schedule 10, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.

2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.

3. Joints: Welded in accordance with AWS D1.1/D1.1M.

4. Casing: Closed glass cell insulation.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110/A21.10, standard thickness.

2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.

3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.

1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.

2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.

3. Ductile iron Fittings: ASTM A536, Grade 65-45-12. In applicable sizes, fittings shall be short pattern, with flow equal to standard pattern fittings.

a. Basis of Design: Victaulic FireLock.

4. Mechanical Grooved Couplings: Two ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 compliant steel bolts, nuts; galvanized for galvanized pipe.

a. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping at specific torque ratings are not permitted.

1) Installation-Ready for complete installation without field disassembly.

2) Basis of Design: Victaulic Style 009N and 107N.

b. Flexible Type: For use in locations where vibration attenuation and stress relief are required.

1) Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.

c. Installation-Ready gaskets are center-leg, with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.

5. Installation-Ready fittings for Schedule 40 & 10 grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready ends, orange enamel coated, red enamel coated or galvanized. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).

6. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. CPVC Pipe (for Residential NFPA 13R applications only): ASTM F442/F442M, SDR 13.5.

1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.

2. Joints: Solvent welded, using ASTM F493 cement.

2.4 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.

2. Provide sealant for watertight joint.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc-coated or cast-iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:

1. Brass pipe.

2. Connect sleeve with floor plate.

E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

G. Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.

3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.5 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:

1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall or casing opening.

2. Watertight seal between pipe and wall-sleeve, wall or casing opening.

3. Size and select seal component materials in accordance with service requirements.

4. Service Requirements:

a. Corrosion resistant.

b. Underground, buried, and wet conditions.

5. Glass-reinforced plastic pressure end plates.

B. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.

C. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.

D. Pipeline-Casing Seals:

1. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

2.6 ESCUTCHEONS

A. Material:

1. Chrome-plated.

2. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.

2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.7 PIPE HANGERS AND SUPPORTS

A. Supporting Elements: provide UL/FM components per NFPA 13, ANSI B 31.1 and MSS SP-58 except that "C" clamps or any modification thereof are unacceptable.

1. "C" clamps: With set screw, locknut and restraining strap are acceptable for piping up to 2-1/2".

B. Furnish necessary piping and equipment supporting elements including; building structure attachments; supplementary steel; hanger rods, stanchions and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides.

C. Center Loading Beam Clamps: For attachments to building structure as approved except piping supported from top of steel.

D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

E. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.8 MECHANICAL COUPLINGS

A. Manufacturers:

1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.

2. Victaulic Company: www.victaulic.com/#sle.

3. Anvil/Gruvlok: www.anvilintl.com

4. Substitutions: See Section 016000 - Product Requirements.

B. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.

2. Minimum Working Pressure: 300 psig.

3. Housing Material: Fabricate of ductile iron complying with ASTM A536.

4. Gasket Material: EPDM-HP suitable for operating temperature range from minus 30 degrees F to 250 degrees F.

5. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

C. Only use grooved coupling as permitted by NFPA 13 and NFPA 14.

2.9 INCOMING FIRE SERVICE BACKFLOW PREVENTER

A. A backflow preventer assembly shall be installed on fire protection systems when connected to a drinking water supply. Degree of hazard present and type of incoming service backflow peventer shall be coordinated with the Authority Having Jurisdiction.

B. Double Check Detector Assembly

1. ASSE 1048, UL 1469, AWWA C510-92: The main valve body shall be manufactured from 300 Series stainless-steel to provide corrosion resistance, 100% lead free* through the waterway. The double check detector assembly consists of two independently operating, spring loaded check valves, two UL, FM, OSY resilient seated gate valves, and bypass assembly. The bypass assembly consists of a meter, a double check including shutoff valves and required test cocks. Each cam-check shall be internally loaded and provide a positive drip tight closure against reverse flow. Cam-check includes a stainless-steel cam arm and spring, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The check valve seats shall be of molded thermoplastic construction. The use of seat screws as a retention method is prohibited. All internal parts shall be accessible through a single cover on the valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The bypass line shall be hydraulically sized to accurately measure low flow. The bypass line shall consist of a meter, a small diameter double check assembly with test cocks and isolation valves. The bypass line double check valve shall have two independently operating modular poppet check valves, and top mounted test cocks.

2. May be installed horizontal or vertical "flow up" position.

3. Basis of Design: Ames Series 3000SS

PART 3 EXECUTION

3.1 FIRE SUPPRESSION PIPING APPLICATIONS

A. CPVC pipe, Schedule 40 or Schedule 80 CPVC fittings, and solvent-cemented joints may be used for residential occupancies ONLY.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:

1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

2. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

4. Schedule 10, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.

5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

D. High-pressure, wet-pipe sprinkler system, shall be one of the following:

1. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

3.3 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

2. Place hangers within 12 inches of each horizontal elbow.

3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.

2. Aboveground Piping:

a. Pack solid using mineral fiber complying with ASTM C592.

b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

L. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.

2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a watertight seal.

6. Install in accordance with manufacturer's recommendations.

M. Escutcheons:

1. Install and firmly attach escutcheons at piping penetrations into finished spaces.

2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.

3. Attach plates at the underside only of suspended ceilings.

4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

O. Grooved joints shall be installed in accordance with the manufacturer’s latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer’s factory trained field representative shall provide on-site training for contractor’s field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

P. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect before proceeding with work.

Q. Where there is evidence that parts of fire protection work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.

R. Fire protection work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.

S. Accessibility:

1. Install fire protection work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.

2. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear openings of swinging and overhead doors and of access panels.

T. When necessary to install "U"-shaped dip in a pipe due to a conflict with duct work or other building components, Contractor shall install a ¾" diameter hose nipple and cap pointing down at lowest point in pipe dip. Contractor shall try to arrange piping layout to avoid such dips; no such dip shall be installed without prior approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.

U. When necessary to install inverted "U" in branch piping to rise above an obstruction, Contractor shall install an upright ¾" diameter air vent nipple and cap at high point of inverted "U". Contractor shall try to arrange piping layout to avoid such high points; no such installation shall be made without approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.

V. Contractor shall provide Owner with at least 24 hours prior notice before commencing sprinkler installations. Owner shall be responsible for deactivating building alarm system and notifying local fire department or other agencies. Under no circumstances shall Contractor attempt to deactivate building alarm system or circumvent any valve tamper switch. Contractor shall perform all work during normal business hours. By the end of each working day, Contractor shall cap all pipe ends.

W. Pressure test completed work in progress, repair any leaks and otherwise make the sprinkler system water tight so that fire alarm and sprinkler protection system can be reactivated by Owner during non-business hours.

3.4 SOUND CONTROL

A. Penetrations shall be maintained airtight to prevent sound transfer.

B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.5 CLEANING

A. Flush entire piping system of foreign matter in accordance with NFPA 13.

B. Upon completion of work, clean all parts of the installation.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

3.6 TESTING AND ACCEPTANCE

A. After completing branch system, Contractor shall test fire sprinkler piping hydrostatically for a period of two hours at not less than 200 psi or at 50 psi in excess of the maximum operating static pressure when the maximum static pressure exceeds 150 psi. Contractor shall check system for leakage of joints and measure hydrostatic pressure at low point of each system or zone being tested.

B. The Contractor shall repair or replace piping and fittings as required to eliminate leakage (in accordance with NFPA standards for "little or no leakage") and retest as specified to demonstrate compliance.

C. Upon satisfactory completion and testing of branch piping system, Contractor shall provide Owner with a letter certifying that branch piping system has been completed in accordance with NFPA 13 and is operational, complete and has no defects.

D. Test shall be witnessed by Architect/Owner and any authorities having jurisdiction who may so require.

SECTION 210523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bronze butterfly valves with indicators.

B. Iron butterfly valves with indicators.

C. Check valves.

D. Bronze OS&Y gate valves.

E. Iron OS&Y gate valves.

F. Trim and drain valves.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 210553 - Identification for Fire Suppression Piping and Equipment.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

D. Section 284600 - Fire Detection and Alarm.

1.3 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.4 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Where listed products are specified, provide products listed, classified, and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Grooved end valves shall be of the same manufacturer as the adjoining couplings.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.

2. Handwheel: For other than quarter-turn trim and drain valves.

3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.2 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 175 psig.

B. Body Material: Bronze.

C. Seat: EPDM.

D. Stem: Bronze or stainless steel.

E. Disc: Bronze with EPDM coating.

F. Actuator: Worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

2.3 IRON BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 300 psig.

B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

C. Seat: Pressure-responsive EPDM.

D. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.

E. Disc: Ductile iron, electroless-nickel plated.

F. Actuator: Weatherproof actuator housing with worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

H. Body Design: Grooved-end connections.

1. Basis of Design: Victaulic Series 705.

2.4 CHECK VALVES

A. Minimum Pressure Rating: 250 psig.

B. Type: Center guided or spring-assisted swing check valve for vertical or horizontal installation.

C. Body Material: Cast iron, ductile iron.

D. Center guided check with elastomeric seal or elastomer coated disc.

E. Hinge Spring: Stainless steel.

F. End Connections: Flanged, grooved, or threaded.

1. Basis of Design: Victaulic Series 717.

2.5 BRONZE OS&Y GATE VALVES

A. Minimum Pressure Rating: 175 psig.

B. Body and Bonnet Material: Bronze or brass.

C. Wedge: One-piece bronze or brass.

D. Wedge Seat: Bronze.

E. Stem: Bronze or brass.

F. Packing: Non-asbestos PTFE.

G. Supervisory Switch: External.

H. End Connections: Threaded.

2.6 IRON OS&Y GATE VALVES

A. Body and Bonnet Material: Cast or ductile iron.

B. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

C. Stem: Brass, bronze, or stainless steel.

D. Packing: Non-asbestos PTFE or EPDM.

E. Supervisory Switch: External.

F. Basis of Design: Victaulic Series 771.

2.7 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:

a. Pressure Rating: 175 psig.

b. Body Design: Two piece.

c. Body Material: Forged brass or bronze.

d. Port Size: Full or standard.

e. Seat: PTFE.

f. Stem: Bronze or stainless steel.

g. Ball: Chrome-plated brass.

h. Actuator: Hand-lever.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine grooved ends for form and cleanliness. Ends shall be clean and free from indentations and projections, and roll marks in the area from valve end to (and including) the groove.

3.2 INSTALLATION

A. Comply with specific valve installation requirements and application in all applicable Division 21 Sections.

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.

1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Provide drain valves plugged with hose adapter with cap and chain at main shut off valves, low points of piping and any apparatus. Drain valve to be size ¾" minimum.

D. Provide OS&Y gate valves for shut-off or isolating services. Valves to have OS&Y tamper monitor switch as required by NFPA or where indicated on drawings.

E. Where approved, butterfly valves may be used instead of gate valves. Valves to have tamper monitor switch as required by NFPA or where indicated on drawings.

F. In addition to tamper monitor switches (only if required by Owner or local authorities), provide each control valve with approved padlock and chain. All padlocks shall be keyed alike

G. Provide hand wheels for gate valves.

H. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

I. Valves in horizontal piping installed with stem at or above the pipe center.

J. Position valves to allow full stem movement.

K. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

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SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.

B. Pumps: Nameplates.

C. Valves: Nameplates.

2.2 NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.

2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.

3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Laminated three-layer plastic with engraved letters.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 210553 - Identification for Fire Suppression Piping and Equipment.

D. Section 211200 - Fire-Suppression Standpipes: Fire Department Connections.

1.3 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Current Edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.

3. Sprinkler Wrenches: For each sprinkler type.

E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.5 QUALITY ASSURANCE

A. Comply with UL (DIR) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers, Specialties, and Equipment:

1. Victaulic Company: www.victaulic.com

2. Anvil/Viking Corporation: www.vikinggroupinc.com/#sle.

3. Reliable Sprinkler: www.reliablesprinkler.com

4. Substitutions: See Section 016000 - Product Requirements.

2.2 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Occupancy: Refer to Schedule on Drawings.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections as required by NFPA.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3 SPRINKLERS

A. Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.

B. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.

1. Response Type: Quick.

2. Coverage Type: Standard.

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

a. Basis of Design: Victaulic Model V38.

C. Exposed Area Type: Pendant type with guard.

1. Response Type: Quick.

2. Coverage Type: Standard.

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

a. Basis of Design: Victaulic Model V27.

D. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate.

1. Response Type: Quick.

2. Coverage Type: Standard.

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Flexible Drop System: Stainless steel, multiple use, open gate type.

1. Application: Use to properly locate sprinkler heads.

2. Include all supports and bracing.

3. Provide braided type tube as required for the application.

4. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

5. The drop shall include a UL approved Series AH1 with 3” bend radius; AH2 or AH2-CC braided hose with a bend radius to 2” to allow for proper installation in confined spaces.

6. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.

7. Manufacturers:

a. FlexHead Industries, a brand of Anvil International: www.anvilintl.com/#sle.

b. Victaulic Company; Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108].

c. Substitutions: See Section 016000 - Product Requirements.

8. In lieu of rigid connections to dry sprinkler heads, a Victaulic VicFlex™ dry sprinkler, Model VS1, may be used. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2", and allow for up to 4 bends

9. In lieu of rigid pipe offsets or return bends for sprinkler drops in wet, dry, and preaction systems in cold storage applications, the Victaulic VicFlex™ V33, V36, or V40 Dry Sprinkler with Integral AB6 Assembly may be used.

10. In lieu of threaded steel piping systems, the Victaulic FireLock IGS System with "Installation-Ready™ fittings and couplings may be used for NPS 1 (DN 25) Schedule 10 and Schedule 40 carbon steel pipe in fire protection applications. System rated for a working pressure to 365 psi (2517 kPa).

a. Groove: IGS "Innovative Groove System" groove with shortened "A" dimension and tapered groove backside for ease of installation.

b. Grooving Tool: Victaulic RG2100, with IGS Confirmation Gauge.

c. Victaulic V9 sprinkler heads may be used in direct substitution where applicable.

2.4 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:

1. Activate electric alarm.

2. Test and drain valve.

3. Replaceable internal components without removing valve from installed position.

4. Manufacturers:

a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.

b. Substitutions: See Section 016000 - Product Requirements.

B. Riser Manifold Assemblies

1. Riser Manifold: integral vane type flow switch and test drain assembly with pressure gauge, grooved connections, 250 psi maximum working pressure; all components to be UL listed.

2. Universal Manifold Check Assembly: Ductile iron construction, incorporating a control valve, check valve, flow switch, adjustable relief valve, and system gauges in one compact body/footprint. The assembly should include the following additional capabilities and features:

   a. Activate electric alarm.

   b. Test and drain assembly with a universal test orifice and adjustable relief valve with a range of 175 to 310 psi.

   c. Replaceable internal components without removing valve from installed position.

   d. Rated for use at the maximum service pressure of 300 psi.

   e. UL Listed and FM Approved.

   f. Manufacturers:

      1) Victaulic Company; Model Globe UMC: https://globesprinkler.com/product-detail/umc-floor-control-shotgun-riser-assembly.

      2) Substitutions: See Section 01 6000 - Product Requirements.

C. Test Connections:

1. Inspector's Test Connection:

   a. Acceptable Manufacturers

      1) AFG Manufacturing

      2) Elkhart Brass

      3) Guardian Fire Equipment Inc.

      4) Potter-Roemer

   b. UL/FM Cast brass body with spring loaded position indicator with positive shut-off. In-line flow with self-draining, clearable sight glass. Tamper-proof orifice permanently installed. Model 1000 Test and Drain manufactured by AFG Manufacturing Inc.

2. Backflow Preventer Test Connection:

   a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.

b. Furnish one valve for each 250 gpm of system demand or fraction thereof.

c. Provide permanent sign reading "Test Valve" in accordance with Section 210553.

D. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

E. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate outside alarm gong on building wall as required.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

G. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.

H. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

J. Flush entire piping system of foreign matter.

K. Hydrostatically test entire system.

L. Require test be witnessed by Fire Marshal.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

SECTION 220005
BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. This section applies to all sections of Division 22.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.2 APPLICATION

A. This section applies to all plumbing work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.

B. The plumbing contractor is responsible for the installation and operation of the plumbing systems.

C. The plumbing contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.3 INSPECTION OF SITE

A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

C. Install Work in locations shown on Drawings, unless prevented by Project conditions.

D. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

1.4 ALTERNATES AND SUBSTITUTIONS

A. Refer to Division 01 - General Requirements for procedures to submit products by a Manufacturer that is not listed as approved equal in the Specifications.

1.5 **DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER**

A. Products identified wiithin the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should Division 22 Contractor submit products by a manufacturer other than that indicated as Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design and coordination of any differing dimensions and clearances with all other trades. This evaluation shall be included as part of the proposed product submittal.

1.6 MATERIALS

A. Plumbing equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

B. The Plumbing trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22 of these specifications, including all wiring devices, transformers, conduit, etc. Any conduits used for control wiring shall meet the specifications as indicated in Division 26.

C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.7 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for plumbing work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 22 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.8 MAINTENANCE

A. Provide 8 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.

B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manuals shall be submitted in electronic format for review. When approved, four (4) bound hard copies and an indexed electronic PDF shall be provided to the owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.9 WARRANTY AND GUARANTEE

A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.10 SUBMITTALS

A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and Division 1 General Requirements.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (plumbing piping, plumbing fixtures, etc.). Refer to other sections of the electrical specifications for additional requirements.

C. Shop Drawings: Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼” equals 1’ 0” scale, and shall be newly prepared by the Contractor and not reproduced from the Architect’s drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.

D. Contractor shall obtain Engineer’s approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.

E. The Engineer’s review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the Owner, irrespective of any approval by the Engineer.

1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Architect, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.

2. Record documents shall be submitted in compliance with the requirements of the Specifications.

F. Engineer WILL NOT REVIEW:

1. Submittals not specified.

2. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.

3. Submittals made after work is delivered to site and/or installed.

4. Submittal resubmissions unless resubmission is required by Architect/Engineer.

G. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.

H. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from errors in submittals.

I. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.

1.11 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:

1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.

2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.12 QUALITY ASSURANCE

A. Other referenced standards:

1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE.

PART 2 PRODUCTS

2.1 SLEEVES AND ESCUTCHEONS

A. Provide sleeves wherever pipes pass through exterior wall and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.2 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

B. Dielectric waterway fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service.

2.3 BUILDING ATTACHMENTS FOR PLUMBING WORK SUPPORTS

A. General Requirements:

1. Provide building attachments required for supporting plumbing work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.

2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.

3. If specially designed building attachments are required, retain the services of a licenced structural engineer to design such building attachments.

4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.

5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:

1. Support plumbing work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.

a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.

b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:

1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:

1. Where plumbing work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

PART 3 EXECUTION

3.1 GENERAL

A. Existing piping: when encountered during the course of work, protect, brace and support existing piping where required for proper execution of the work.

B. Interruption of existing active piping: when the course of work makes shut-down of services unavoidable, the plumbing contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.

C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderiy fashion.

D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.2 INTERPRETATION OF CONTRACT DOCUMENTS

A. Should there be discrepancy or a question of intent, refer matter to Architect/Engineer for decision before ordering any equipment or materials or before starting any related work.

B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.

C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such system whether or not specifically called for by Specifications or Drawings.

D. Architect/Engineer may change location of any equipment 5' and any piping, ductwork, conduit, etc. 10' in any direction without extra charge, provided such changes are made before installation.

E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Architect/Engineer.

F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.

1. Where headroom or space conditions appear inadequate, notify Architect or Owner's field representative before proceeding with installation.

2. Pipe/duct rerouting and size changes shall be made at no additional cost to the Owner.

G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.

H. Where there is evidence that parts of the Work specified in Divisions 21, 22, and 23 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.

I. After review and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.

J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the Owner.

K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the Owner's Insurance Underwriters, shall be made by the Contractor without extra cost to the Owner.

L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.

M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the Owner.

N. The Equipment Shop Drawings should be furnished to the installing Contractor by the purchasing Contractor before roughing in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

3.3 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS

A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.

B. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the Owner and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the Owner or the Architect.

3.4 ACCESSIBILITY

A. Do not locate traps, valves, controls, unions, cleanouts, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in plumbing systems.

3.5 ACCESS PANELS:

A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.

B. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.

C. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.

D. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

E. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials.

3.6 PROTECTION OF ELECTRICAL EQUIPMENT

A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3’ access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers.

1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4” high turned up edge. Bottom of drain pan shall slope to a single drainage point at ⅛” per foot. A 1” diameter clear plastic tube shall allow collected fluid to drain to the nearest open site floor drain. Secure plastic tubing to building structure only.

2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.

3. Drain pans shall include liquid detectors with alarms only if noted on the drawings. Liquid detectors shall be specified in Section 22 10 06 Plumbing Piping Specialties.

B. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to Owner, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space.

3.7 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to Division 01 - General Requirements.

B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.

C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.8 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, removal of materials, de-watering and backfilling required for the proper laying of pipes and plumbing work. Coordinate the work with other excavating and backfilling in same area.

3.9 ROUGH-IN FOR CONNECTION TO EQUIPMENT

A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.10 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.11 SEAL PENETRATIONS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.12 SOUND CONTROL

A. Penetrations shall be maintained airtight to pevent sound transfer.

B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.13 FIRESTOPPING

A. Refer to Division 07 - Thermal and Moisture Protection for more information.

B. Provide UL classified firestopping system for plumbing penetrations through rated walls and floors to maintain the fire rating.

3.14 CONTROL WIRING

A. All control wiring for plumbing and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

3.15 CLEANING, FLUSHING, AND INSPECTING

A. Refer to Division 01 - General Requirements; all plumbing equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

B. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

C. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4' per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.

D. Inspect pressure piping in accordance with procedures of ASME B31.

3.16 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; all equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager/General Contractor and be performed in a manner as to avoid damage, deterioration and loss.

C. Contractor shall provide temporary protection for installed equipment prior to project completion.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.

F. Protect plumbing fixtures and piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.17 PIPING TESTS

A. Test pressure piping in accordance with ASME B31.

B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Test each piping system at 150% of operating pressure, or other pressure as required by Authority Having Jurisdiction, whichever is greater.

a. Domestic water systems and equipment vents shall be tested hydrostatically for minimum of four hours at 1½ times design pressure for that system, or 100 psig minimum, whichever is greater, unless otherwise specified.

b. Storm, soil, waste and vent piping shall be tested with water for minimum of 24 hours at 10 feet head.

c. Acid resistant waste and vent systems shall be tested as per manufacturer's recommendations.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

SECTION 220516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 125 psi up to 2 inch.

D. Maximum Service Temperature: 450 degrees F.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Copper piping.

2.2 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:

1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets.

C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.

D. Maximum Working Pressure: 150 psi at 800 degrees F.

E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.

1. Selected Product to Accommodate:

a. Angular Rotation: 15 degrees.

b. Force developed by 1.5 times specified maximum allowable operating pressure.

2. Provide necessary accessories including, but not limited to, swivel joints.

2.3 ACCESSORIES

A. Swivel Joints:

1. Bronze body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

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SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220523 - General-Duty Valves for Plumbing Piping.

C. Section 220553 - Identification for Plumbing Piping and Equipment: Piping identification.

D. Section 220716 - Plumbing Equipment Insulation.

E. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.

2. Provide sealant for watertight joint.

3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.

4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

F. Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.

3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.2 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:

1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.

2. Watertight seal between pipe and wall-sleeve, wall or casing opening.

3. Size and select seal component materials in accordance with service requirements.

4. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:

1. Provide packing and sealing compound to fill pipe to sleeve thickness.

2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:

1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.

2. Masonry Structures: Sheet metal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations: Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.

2. Aboveground Piping:

a. Pack solid using mineral fiber complying with ASTM C592.

b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

F. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.

2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a water-tight seal.

6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

SECTION 220519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges.

B. Thermometers.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).

B. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements. for additional provisions.

2. Extra Pressure Gauges: One of each type and size.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Ashcroft, Inc: www.ashcroft.com/#sle.

2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

4. Omega Engineering a subsidiary of Spectris, Plc: www.omega.com/#sle.

5. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

6. Substitutions: See Section 016000 - Product Requirements.

B. Bourdon Tube for Liquids and Gases:

1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.

2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.

3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.

4. Process Connection: Lower-back, 1/4 inch NPT male except where noted.

C. Accessories:

1. Gauge Cock: Carbon steel with tee or lever handle for maximum 150 psi.

2.2 THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

3. Watts Water Technologies, Inc: www.watts.com/#sle.

4. Weiss Instruments, LLC: www.weissinstruments.com/#sle.

5. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

6. Substitutions: See Section 016000 - Product Requirements.

B. General:

1. Product Compliance: ASTM E1.

2. Lens: Clear glass, except where stated.

3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.

4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

C. Thermometers - Adjustable Angle: 7 inch v-shape aluminum case with clear glass window scale, 6 inch NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

3.2 INSTALLATION

A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.

B. Install pressure gauges as follows:

1. At Pumps: Place single gauge before strainer, suction side and discharge side.

2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.

3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.

C. Install thermometers as follows:

1. Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.

2. Piping, where indicated on details or plans: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch to accommodate sockets. Ensure sockets are above insulation clearance.

3.3 SCHEDULES

A. Pressure Gauges, Location and Scale Range:

1. Pumps, 0 to 100 psi.

2. Expansion tanks, 0 to 80 psi.

3. Pressure reducing valves, 0 to 120 psi.

B. Stem Type Thermometers, Location and Scale Range:

1. Domestic hot water supply and recirculation, 0 to 180 degrees F.

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SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ball valves.

B. Butterfly valves.

C. Check valves.

D. Gate valves.

E. Manual balancing valves.

F. Automatic balancing valves.

G. Drain valves.

H. Relief valves.

1.2 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 220716 - Plumbing Equipment Insulation.

D. Section 220719 - Plumbing Piping Insulation.

E. Section 221005 - Plumbing Piping.

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. PTFE: Polytetrafluoroethylene.

E. TFE: Tetrafluoroethylene.

F. WOG: Water, oil, and gas.

1.4 REFERENCE STANDARDS

A. ASTM F-2389-07 Standard Specification for Pressure-rated Polypropylene (PP) Piping.

B. CSA B137.11 Polypropylene (PP-R) Pipe and Fittings for Pressure Applications.

C. DIN-DVS 2207-112017 Welding Thermoplastic materials – Heated element welding of pipes, piping parts, and panels made of polypropylene.

D. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

E. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

F. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

G. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022.

H. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

I. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.

J. ASME B31.9 - Building Services Piping; 2020.

K. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

L. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

M. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

N. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

O. AWWA C606 - Grooved and Shouldered Joints; 2022.

P. MSS SP-67 - Butterfly Valves; 2022.

Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

R. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

T. NSF 61 - Drinking Water System Components - Health Effects; 2023.

U. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Grooved joint valves shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Grooved end valves shall be of the same manufacturer as the adjoining couplings.

D. All castings used for valve bodies shall be date stamped for quality assurance and traceability.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.

a. Provide temporary inlet and outlet caps.

b. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B. Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball or butterfly.

a. Gate valves shall only be used on shut off for pumped sanitary/storm piping only.

b. High performance ball valves shall be used in "Critical Service" applications. Contractor shall ask Engineer and Owner prior to submittal stage, what areas of the project are "Critical Service".

2. Dead-End: Single-flange butterfly (lug) type.

3. Swing Check:

a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

4. Spring Loaded Check: At pump discharge.

5. Automatic Balancing Valves: At all domestic hot water connections to hot water return piping.

6. Manual Balancing Valves: At hot water return pump discharge only.

C. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

D. Domestic, Hot and Cold Water Valves:

1. 2 inch and Smaller:

a. Ball: Two piece, full port, bronze with bronze or stainless steel trim.

1) Hot Forged brass valves by Bonomi are allowed as specified below. Only ASTM C28500 alloy allowed.

b. Bronze Swing Check: Class 125, bronze disc.

c. Bronze or Hot Forged Brass Spring Loaded Check: Class 125, nonmetallic disc

2. 2-1/2 inch and Larger:

a. Iron Ball: Class 150.

b. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.

c. Grooved End, Cast Brass Butterfly: 300 CWP, Fluoroelastomer pressure-responsive seat, aluminum-bronze disc.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Gear Actuator: Quarter-turn valves 8 inch and larger.

2. Handwheel: Valves other than quarter-turn types.

3. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Insulated Piping Valves: With 2 inch stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

2. Butterfly Valves: Extended neck.

3. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.

2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.

3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.

4. Solder Joint Connections: ASME B16.18.

5. Grooved End Connections: Copper-tube dimensions, similar to AWWA C606.

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.

2. Solder-joint Connections: ASME B16.18.

3. Building Services Piping Valves: ASME B31.9.

G. Potable Water Use:

1. Certified: Approved for use in compliance with NSF 61 and NSF 372.

2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRONZE, BALL VALVES

A. General:

1. Fabricate from dezincification resistant material.

2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze or Stainless Steel Trim:

1. Comply with MSS SP-110.

2. WSP Rating: 150 psi.

3. CWP Rating: 600-1000 psig.

4. Body: Lead Free Bronze.

5. Ends Connections: Pipe thread or solder.

6. Seats: PTFE or TFE.

7. Manufacturers:

   a. Apollo Valves: www.apollovalves.com/#sle. BRONZE VALVES ONLY

   b. Nibco: www.nibco.com BRONZE VALVES ONLY

   c. Bonomi www.bonominorthamerica.com Lead Free Hot Forged Brass Ball Valves are allowed; only ASTM C28500 alloy is permitted.

   d. Substitutions: See Section 016000 - Product Requirements.

C. High Performance Ball Valves (up to 2"), Two Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110/145

2. WSP Rating: 150 psi.

3. CWP Rating: 1,000 psi.

4. Body: Bronze.

5. End connections: Pipe thread, solder or press.

6. Seats: Reinforced PTFE

7. Operator: Reversable handle.

8. Manufacturers:

   a. Nibco: www.nibco.com

2.4 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug Style; Bi-directional dead-end service without use of downstream flange:

1. Class 125 or Class 150 flanges.

2. Comply with MSS SP-67, Type I.

3. Lug Style, Service Pressure Ratings:

   a. 100 psi for sizes 14 to 24 inch.

   b. 150 psi for sizes 2 to 12 inch.

   c. Vacuum down to 29.9 in-Hg.

4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.

5. Stem: One or two-piece stainless steel.

6. Seat: EPDM.

7. Finish: Epoxy coated.

8. Operator: Gear operator with handwheel over direct-mount actuator base.

9. Manufacturers:

   a. Apollo Valves: www.apollovalves.com/#sle.

   b. Jomar Valves, a division of Jomar Group: www.jomarvalve.com/#sle.

   c. Pratt Industrial www.prattindl.com

   d. Substitutions: See Section 016000 - Product Requirements.

2.5 BRASS, GROOVED-END BUTTERFLY VALVES

A. Grooved Ends: Bi-directional dead-end service.

1. CWP Rating: 300 psig.

2. Body: Cast brass, UNS C87850.

3. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.

4. Seat: Pressure responsive Fluoroelastomer.

5. Disc: Aluminum-bronze.

6. UL classified in accordance with NSF-61 for potable water service, and meets the lead requirements of NSF-372.

7. Manufacturer: Victaulic

2.6 BRONZE, SWING CHECK VALVES

A. General:

1. Fabricate from dezincification resistant material.

2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125: CWP Rating: 200 psig (1380 kPa).

1. Comply with MSS SP-139, Type 3.

2. Design: Y-pattern, horizontal or vertical flow.

3. Body: Bronze, ASTM B62.

4. Ends: Threaded or soldered as indicated.

5. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Jomar Valves, a division of Jomar Group: www.jomarvalve.com/#sle.

c. Milwaukee: www.milwaukeevalve.com.

d. Kitz: www.kitz-kca.com

e. Nibco: www.nibco.com

f. Substitutions: See Section 016000 - Product Requirements.

2.7 BRONZE SPRING LOADED CHECK VALVES

A. Class 125: CWP Rating 200 psig (1380 kPa).

1. Design: Vertical flow.

2. Body: Bronze, ASTM B61 or ASTM B62

3. Spring: Bronze

4. Ends: Threaded or soldered as indicated.

5. Disc: Nonmetallic

6. Manufacturers:

a. Milwaukee: www.milwaukeevalve.com

b. Apollo Valves[<>]: www.apollovalves.com/#sle.

c. Bonomi: www.bonominorthamerica.com; Hot Forged Brass Material approved

d. Substitutions: See Section01 6000-Product Requirements.

2.8 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.

1. Comply with MSS SP-71, Type I.

2. Description:

a. CWP Rating: 200 psi.

b. Design: Clear or full waterway.

c. Body: ASTM A126, gray iron or ductile iron with bolted bonnet.

d. Ends: Flanged or threaded as indicated.

e. Spring: Stainless steel.

f. Trim: Bronze or stainless steel.

g. Gasket: Asbestos free.

h. Closer Control: Factory installed, exterior lever, and spring.

3. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Flomatic Valves: www.flomatic.com/#sle.

c. Nibco: www.nibcoc.com.

d. Substitutions: See Section 016000 - Product Requirements.

2.9 MANUAL BALANCING VALVES

A. Construction: Class 125, Lead free brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain, calibrated nameplate with memory stop.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

C. Manufacturers:

1. ITT Bell & Gossett: www.bellgossett.com/#sle.

2. Jomar Valve: www.jomarvalve.com

3. Caleffi; www.caleffi.com

4. Nibco: www.nibco.com

5. Substitutions: See Section 01 6000 - Product Requirements.

2.10 AUTOMATIC BALANCING VALVES

A. Thermostatic balancing valves up to 1-1/4":

1. Manufacturers:

a. ITT Bell & Gossett; Temp Setter: www.bellgossett.com

b. Caleffi; Thermosetter: www.caleffi.com

c. Acorn Controls; TempFlow: www.acorncontrolsvalves.com

d. Substitutions: See Section 01 6000 - Product Requirements.

2. The valve shall be certified lead free according to NSF/ANSI 61 standards.

3. The valve body shall be constructed out of 316 stainless steel or DZR low-lead brass

4. The valve shall be field adjustable with an adjustment range of at least 100°F (37°C) to 140°F (60°C).

5. The valve shall be insulated either by the factory or in field.

6. The valve shall be installed with isolation valves on either side and an outlet temperature guage. These can be by factory or installed in the field.

2.11 DRAIN VALVES

A. Drain Valve with hose thread and chain and dust cap; chrome plated ball, blow-out-proof stem, and adjustable packing gland.

B. Manufacturers:

1. Hammond: www.hammondvalve.com

2. Apollo valves: www.apollovalves.com

3. Bonomi www.bonominorthamerica.com

4. Nibco: www.nibco.com/valves

5. Milwaukee: www.milwaukeevalve.com

6. Jomar: www.jomarvalve.com

7. Substitutions: See Section 01 6000 - Product Requirements.

2.12 RELIEF VALVES

A. Pressure Relief Valves: Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

B. Manufacturers:

1. CASH (A.W.) Valve Manufacturing Corp: www.cashvalve.net

2. Zurn Industries; Wilkins-Regulator Division: www.zurn.com

3. Watts Regulator Company: www.wattsregulator.com

4. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Provide access where valves and fittings are not exposed.

E. Install check valves where necessary to maintain direction of flow as follows:

1. Spring Loaded Check: Install with stem plumb and vertical.

2. Swing Check: Install horizontal maintaining hinge pin level.

F. Provide chainwheels on operators for valves 4 inch and larger where located 96 inch or more above finished floor, terminating 60 inch above finished floor.

G. Install valves with stems upright or horizontal, not inverted.

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SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Underground warning tape.

1.2 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:

1. Heat exchangers, water heaters, and other heat transfer products.

2. Control panels, transducers, and other related control equipment products.

3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:

1. Piping: 3/4 inch diameter and smaller.

2. Manual operated valves and automated control valves.

C. Pipe Markers: 3/4 inch diameter and higher.

2.2 NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.

2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

3. Seton Identification Products: www.seton.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Engraved piece with up to three lines of text.

1. Letter Color: White.

2. Letter Height: 1/4 inch.

3. Background Color: Black.

4. Nameplate Material:

a. Flexible: Polycarbonate with adhesive backing per ASTM D709.

b. Metal: Brass with adhesive backing.

2.3 TAGS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.

2. Brimar Industries, Inc: www.pipemarker.com/#sle.

3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

4. Seton Identification Products: www.seton.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

C. Piping: 3/4 inch diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.4 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.

2. Brimar Industries, Inc: www.pipemarker.com/#sle.

3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

4. Seton Identification Products: www.seton.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

E. Identification Scheme, ASME A13.1:

1. Primary: External Pipe Diameter, Uninsulated or Insulated.

2. Secondary: Color scheme per fluid service.

a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

3. Tertiary: Other Details.

a. Directional flow arrow.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.

2. Brimar Industries, Inc: www.brimar.com/#sle.

3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

4. Seton Identification Products: www.seton.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, 0.005 inch, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Install plastic pipe markers in accordance with manufacturer's instructions.

1. Install in clear view and align with axis of piping.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Apply ASME A13.1 Pipe Marking Rules:

1. Place pipe marker adjacent to changes in direction.

2. Place pipe marker adjacent each valve port and flange end.

3. Place pipe marker at both sides of floor and wall penetrations.

4. Place pipe marker every 25 to 50 feet interval of straight run.

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Glass fiber insulation.

C. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER INSULATION

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Johns Manville Corporation: www.jm.com/#sle.

3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.

2. Maximum Service Temperature: 850 degrees F.

3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.

2. Armacell LLC: www.armacell.us/#sle.

3. K-Flex USA LLC: www.kflexusa.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.

2. Maximum Service Temperature: 220 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:

1. Manufacturers:

a. Johns Manville Corporation: www.jm.com/#sle.

b. Proto Corporation: www.protocorporation.com.

c. Substitutions: See Section 016000 - Product Requirements.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.

b. Maximum Service Temperature: 150 degrees F.

c. Moisture Vapor Permeability: 0.02 per inch (0.029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 10 mil, 0.010 inch.

e. Connections: Brush on welding adhesive.

3. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert Location: Between support shield and piping and under the finish jacket.

4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 SCHEDULES

A. Plumbing Systems:

1. Domestic Hot Water Supply & Recirculation:

a. Pipe Size Range: 1/2 to 1-1/4 inch

1) Thickness: 1 inch

b. Pipe Size Range: 1-1/2 to 8 inch

1) Thickness: 1-1/2 inch

2. Domestic Cold Water: 1 inch thick.

3. Roof Drain Bodies: 1/2 inch thick.

4. Roof Drainage Above Grade: 1/2 inch thick with PVC jacket.

5. Plumbing Vents Within 10 Feet of the Exterior: 1/2 inch thick with PVC jacket.

B. Cooling Systems:

1. Condensate Drains from Cooling Coils: 1 inch thick.

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SECTION 221005
PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.

B. Sanitary waste piping, above grade.

C. Domestic water piping, buried within 5 feet of building.

D. Domestic water piping, above grade.

E. Storm drainage piping, buried within 5 feet of building.

F. Storm drainage piping, above grade.

G. Condensate drains.

H. Pipe flanges, unions, and couplings.

I. Pipe hangers and supports.

1.2 RELATED REQUIREMENTS

A. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2017.

E. ASME B31.9 - Building Services Piping; 2020.

F. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

K. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

O. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

P. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

R. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

S. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

T. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).

U. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

V. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

X. NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

Y. NSF 372 - Drinking Water System Components - Lead Content; 2022.

Z. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.

1. Grooved joint couplings and fittings shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

C. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.8 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing plumbing piping systems with the following minimum working-pressure ratings:

1. Hot-Water Piping: 80 psig at 140 deg. F

2. Hot-Water Return Piping: 80 psig at 140 deg. F

3. Cold-Water Piping: 80 psig at 75 deg. F

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe & Fittings: CISPI 301, ASTM A 888 hubless.

1. Tensile Strength: 21,000 psig minimum.

2. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

3. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

4. Heavy-Duty, Hubless-Piping Couplings:

a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

1) Ideal Tridon

2) ANACO-Husky

3) Tyler Couplings

4) Mission Rubber Company

b. Standards: ASTM C 1540.

c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.

2. Joints: ASTM B32, alloy Sn50 solder.

D. PVC Pipe:

1. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

2. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

3. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40 **will not be accepted**.

4. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.

5. PVC Pressure Fittings: ASTM D 2466, Socket Type

6. Primer: ASTM F 656.

   a. Primer shall have a VOC content of 550g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

   b. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"

7. Solvent Cement: ASTM D 2564.

   a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

   b. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"

2.3 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe & Fittings: CISPI 301, ASTM A 888 hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

3. Tensile Strength: 21,000 psig minimum.

4. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

5. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

6. CISPI, Hubless-Piping Couplings:

   a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

1) Ideal Tridon

2) ANACO-Husky

3) Tyler Couplings

4) Mission Rubber Company

b. Standards: ASTM C 1277 and CISPI 310.

c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop. Couplings shall bear the trademark NSF International.

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.

2. Joints: ASTM B32, alloy Sn50 solder.

2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: Ductile iron, standard thickness.

2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type L (B) or K (A), Drawn (H). Type M (C) will not be accepted.

1. Fittings:

a. ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

b. Grooved end fittings manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

2. Joints:

a. ASTM B32, solder.

b. Grooved joint coupling consisting of two ductile iron housings cast with offsetting angle-pattern bolt pads, Fluoroelastomer center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, and ASTM A449 compliant bolts and nuts. Installation ready rigid coupling for direct stab installation without field disassembly.

1) UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.

3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

a. Manufacturers:

1) Apollo Valves: www.apollovalves.com/#sle.

2) Nibco: www.nibco.com.

3) Substitutions: See Section 016000 - Product Requirements.

2.6 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe & Fittings: CISPI 301, ASTM A 888 hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

3. Tensile Strength: 21,000 psig minimum.

4. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

5. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

6. Heavy-Duty, Hubless-Piping Couplings:

a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

1) Ideal Tridon

2) ANACO-Husky

3) Tyler Couplings

4) Mission Rubber Company

b. Standards: ASTM C 1540.

c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

B. PVC Pipe:

1. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

2. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

3. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40 **will not be accepted**.

4. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.

5. PVC Pressure Fittings: ASTM D 2466, Socket Type

6. Primer: ASTM F 656.

a. Primer shall have a VOC content of 550g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

b. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers”

7. Solvent Cement: ASTM D 2564.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

b. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers”

2.7 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe & Fittings: CISPI 301, ASTM A 888 hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

3. Tensile Strength: 21,000 psig minimum.

4. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF International.

5. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

6. CISPI, Hubless-Piping Couplings:

   a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

      1) Ideal Tridon

      2) ANACO-Husky

      3) Tyler Couplings

      4) Mission Rubber Company

   b. Standards: ASTM C 1277 and CISPI 310.

   c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop. Couplings shall bear the trademark NSF International.

2.8 CONDENSATE DRAINS SERVING INDIVIDUAL EQUIPMENT

A. Copper Tube: ASTM B88 (ASTM B88M), Tyle L (B), drawn; using one of the following joint types:

   1. Solder joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.9 CONDENSATE DRAINAGE SYSTEMS SERVING MULTIPLE PIECES OF EQUIPMENT.

A. Copper Tube: ASTM B88 (ASTM B88M), Tyle L (B), drawn; using one of the following joint types:

   1. Solder joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

B. PVC Pipe: ASTM D2665.

   1. Fittings: PVC

   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.10 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

D. No-Hub Couplings:

1. Testing: In accordance with ASTM C1277 and CISPI 310.

2. General: Comply with ASTM C1277 and CISPI 310.

3. Gasket Material: Neoprene complying with ASTM C564.

4. Band Material: Stainless steel complying with ASTM A240.

5. Eyelet Material: Stainless steel.

6. Manufacturers:

a. MIFAB, Inc: www.mifab.com/#sle.

b. Anaco-Husky: www.anaco-husky.com.

c. Substitutions: See Section 016000 - Product Requirements.

E. Dielectric Connections:

1. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2. Waterway Fitting: Copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall have threaded ends, grooved ends, or a combination.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp. Riser clamps shall be isolated from the building structure by placing felt or rubber pads between the clamp and the structure.

B. Pipe Stands on Rooftops

1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

2. High-Type, Single-Pipe Stand:

a. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration

b. Base: Plastic or Stainless Steel

c. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

d. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

3. High-Type, Multiple-Pipe Stand:

a. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

b. Bases: One or more; plastic.

c. Vertical Members: Two or more protective-coated-steel channels.

d. Horizontal Member: Protective-coated-steel channel.

e. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, grooved joint couplings, or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions. Cast iron soil pipe installed in accordance to CISPI's Handbook.

B. Install aboveground PVC piping according to ASTM D 2665.

C. Install underground PVC piping according to ASTM D 2321.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed. Coordinate size and location of access door with Division 01.

K. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Install valves with stems upright or horizontal, not inverted. See Section 220523.

N. Install water piping to ASME B31.9.

O. Slope water piping and arrange to drain at low points.

P. Install sub-soil drainage piping (perforated) from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and groove end of units up-stream. Lay perforated pipe with perforations down.

Q. Sub-soil drain pipe tube or tile shall be laid in trench with a minimum of 6” gravel on all sides. Provide filter sock and/or filter fabric on pipe.

R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

S. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

T. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

U. Sleeve pipes passing through partitions, walls, and floors.

V. Pipe Stand Installation: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

W. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

X. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

3. Install lateral bracing with pipe hangers and supports to prevent swaying.

4. Provide copper plated hangers and supports for copper piping.

Y. Pipe Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.

2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a watertight seal.

6. Install in accordance with manufacturer's recommendations.

Z. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

AA. In general, all piping, and similar items shall be installed concealed from view above ceiling, in partitions, shafts, chases, unless otherwise indicated.

BB. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect/Engineer before proceeding with work.

CC. Where there is evidence that plumbing work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.

DD. Plumbing work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.

EE. Appliances and equipment to be installed and connected with best engineering practices and in accordance with manufacturer's instructions and recommendations. Piping, valves, connections and other like items recommended by manufacturer or as required for proper operation to be provided without additional cost to Owner.

FF. In no case will any pipe, conduit or duct be installed where it is supported on or suspended from another pipe, conduit or duct.

3.3 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Provide flow controls in water recirculating systems where indicated.

3.4 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope; 1/4 inch per foor slope for piping serving low flow fixtures.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new natural gas service. Coordinate incoming line size, meter location, regulator settings, etc. with Utility Company prior to the start of any work.

C. Provide new water service complete with approved wye strainer, reduce pressure backflow preventer, and water meter with by-pass valves.

1. Provide 18 gauge, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

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SECTION 221006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hose bibbs.

D. Hydrants.

E. Washing machine boxes and valves.

F. Air admittance valves.

G. Backflow preventers.

H. Strainers.

I. Water hammer arrestors.

J. Sanitary waste interceptors.

K. Neutralization tanks for acid waste.

L. Mixing valves.

M. Air vents.

N. Floor drain trap seals.

O. Pump connectors.

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

B. Section 223000 - Plumbing Equipment.

C. Section 224000 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.

D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).

E. NSF 61 - Drinking Water System Components - Health Effects; 2023.

F. NSF 372 - Drinking Water System Components - Lead Content; 2022.

G. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, and other specialties applicable to project.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Loose Keys for Outside Hose Bibbs: One.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Josam Company: www.josam.com/#sle.

3. MIFAB, Inc: www.mifab.com/#sle.

4. Zurn Industries, LLC: www.zurn.com/#sle.

5. Sioux Chief: www.siouxchief.com.

6. Watts: www.watts.com

7. Substitutions: See Section 016000 - Product Requirements.

B. Roof Drains and Overflow Drains:

1. Assembly: ASME A112.6.4.

2. Body: Lacquered cast iron with sump.

3. Strainer: Removable low silhouette cast iron dome with vandal proof screws.

4. Accessories: Coordinate with roofing type:

a. Membrane flange and membrane clamp with integral gravel stop.

b. Adjustable under deck clamp.

c. Roof sump receiver.

d. Waterproofing flange.

e. Adjustable extension sleeve for roof insulation.

f. For Overflow Drain: 2-inch high external water dam.

g. Adjustable extension sleeve for roof insulation.

C. Downspout Nozzles:

1. Bronze round with hinged perforated cover.

D. Floor Drains:

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, and reversible clamping collar.

2. Strainer: Refer to Plumbing Fixture Schedule for size, type and accessories.

E. Shower Channel Drain (): Factory fabricated channel and grate with built in outlet pipe.

1. Basis of Design: Refer to Plumbing Fixture Schedule.

2. Channel Edge: Plain edge.

3. Plumbing Connector Type: Stainless steel.

4. Channel Length: 35-1/2 inches.

5. Grate Style: To be selected by Architect from manufacturer's full range.

6. Substrate Construction: Concrete slab.

7. Material: Electropolished stainless steel.

8. Outlet Pipe: 2 inch diameter.

F. Floor Sinks:

1. Lacquered cast iron body with ABS anti-splash interior bottom dome strainer, light duty grate with slotted openings, white acid resisting porcelain enamel interior and top.

2. Size: refer to Plumbing Fixture Schedule.

3. Grate type: refer to Plumbing Fixture Schedule.

4. Install with lip approximately 1" above finished floor, if required by AHJ.

2.3 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Josam Company: www.josam.com/#sle.

3. MIFAB, Inc: www.mifab.com/#sle.

4. Zurn Industries, LLC: www.zurn.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.4 HOSE BIBBS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.

3. Watts Regulator Company: www.wattsregulator.com/#sle.

4. Zurn Industries, LLC: www.zurn.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Interior Hose Bibbs for Public Areas:

1. Moderate climate, anti-siphon narrow wall hydrant with chrome plated face, integral vacuum breaker, 3/4" hose connection, 360 degree swivel pipe connection with 3/4" female/1" male threads. Bronze head, seat casting, internal working parts, and loose key.

2. Complies with ASSE 1019.

2.5 HYDRANTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.

3. Zurn Industries, LLC: www.zurn.com/#sle.

4. Prier: www.prier.com.

5. Woodford: www.woodfirdmfg.com

6. Substitutions: See Section 016000 - Product Requirements.

B. Wall Hydrants:

1. ASSE 1019; freeze resistant, lead free, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.

C. Roof Hydrants:

1. Non-freeze roof hydrant with ASSE 1052 double check valve, galvanized casing and adjustable flow wheel lock handle with deck flange and underdeck clamp. Lead free. Route drain to nearest floor drain or mop sink.

D. Yard Hydrants:

1. Non-freeze post hydrant with galvanized casing and adjustable flow wheel lock handle. 3/4" NPTF inlet connection and 3/4" outlet box connection.

2.6 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:

1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.

2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.

3. Sioux Chief; www.siouxchief.com.

4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Unit shall allow for mounting with supply lines from top or bottom, on-stud or between-studs. Supply and drain boxes can be connected using provided galvanized U-Clip or separated as desired. Supply box can be inverted. Unit shall be available with ASME A112.18.1 1/4-turn valves and ASSE 1010 water hammer arrestors. Metal support bracket shall install into top/bottom tracks of box. Drain box shall have a 5/8" integral testable nipple on knockout. Outlet connections shall be generally 3/4". Outlet connections should generally be provided with a test/tamper-resistant cap. Valves should be plated. Arrester option handles can be operated together (single throw) or independently.

C. Boxes shall be fire rated when installed in fire rated walls. Coordinate with Architectural plans.

2.7 AIR ADMITTANCE VALVES

A. Manufacturers:

1. IPS Corporation: Studor; www.ipscorp.com

2. Sioux Chief: Turbo Vent; www.siouxchief.com

3. Oatey: Sure Vent; www.oatey.com

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: ASSE 1050 and 1051; Valve shall provide positive seal at 0 psi and under positive line pressure to prevent sewer gasses from entering the occupied space. ABS/PVC body with Schedule 40 adapter and actuating device.

C. When device is located in a wall, provide with recessed access box with vented cover plate. Access box shall be fire rated when installing in fire rated walls. Refer to Architectural drawings.

2.8 BACKFLOW PREVENTERS

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.

2. MIFAB, Inc or BEECO: www.mifab.com/#sle.

3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.

4. Zurn Industries, LLC: www.zurn.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Reduced Pressure Backflow Preventer Assembly:

1. ASSE 1013 and NSF 61 compliant reinforced-nylon body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, integral male test fittings, and non-threaded vent outlet.

2. Size: 3/4 to 2 inch assembly with threaded full port ball valves.

3. Maximum Working Parameters: 175 psi at 180 degrees F.

4. Accessories: Provide air gap fitting and test cocks.

a. Pipe air gap fitting to adjacent floor drain.

C. Reduced Pressure Backflow Preventer Assembly:

1. ASSE 1013 and NSF 61 compliant stainless steel or epoxy coated ductile iron body assembly with corrosion resistant internal parts, stainless steel springs, diaphragm type differential pressure relief valve located between check valves, third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.

2. Configured to protect against backsiphonage and backpressure into potable water supply.

3. Size: 2-1/2 to 10 inch assembly with flanged NRS gate valves.

4. Maximum Working Parameters: 175 psi at 140 degrees F.

5. Accessories: Provide air gap fitting and test cock.

a. Pipe air gap fitting to adjacent floor drain.

6. Device shall be approved for vertical or horizontal installation, as required for project installation.

D. Double Check Valve Backflow Preventers:

1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.9 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com

2. Green Country Filter Manufacturing: www.greencountryfilter.com

3. WEAMCO: www.weamco.com

4. Legend: www.legendvalve.com

5. Substitutions: See Section01 6000-Product Requirements.

B. Size 2 inches and Under:

1. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen. Lead free.

C. Size 1-1/2 inch to 4 inches:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen. Lead free.

2.10 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.

3. Zurn Industries, LLC: www.zurn.com/#sle.

4. Sioux Chief: www.siouxchief.com

5. Substitutions: See Section 016000 - Product Requirements.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 33 to 180 degrees F and maximum 125 psi working pressure.

2.11 SANITARY WASTE INTERCEPTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

2. MIFAB, Inc: www.mifab.com/#sle.

3. Zurn Industries, LLC: www.zurn.com/#sle.

4. Highland Tank: www.highlandtank.com.

5. Schier: https://schierproducts.com/

6. Striem: https://striemco.com

7. Substitutions: See Section 016000 - Product Requirements.

B. Grease Interceptors - Hydromechanical - Exterior Installation Below Grade - Polyethylene

1. Seamless, rotationally-molded polyethylene.

2. Flow control cartridge shall be PVC.

3. Interceptor shall be furnished for above or below grade installation.

4. Interceptor shall be certified to ASME A112.14.3 (Type C) and CSA B481.1, with adjustable cover adapters, Safety Star access restrictor built into each cover adapter, built-in flow control and three outlet options.

5. Interceptor flow rate and capacity shall be as scheduled on Drawings.

6. Cover shall provide water/ gas-tight seal.

7. Interceptor shall be furnished with field cut riser to enable access for below grade installation.

8. Product shall have State of Michigan approval.

C. Solids Interceptors - Below Sinks:

1. Manufacturers:

a. Striem: https://striemco.com/ - Model: Sidekick

b. Substitutions: See Section01 6000-Product Requirements.

2. Materials: injection-molded PVC (housing) and polycarbonate (perforated basket).

3. Perforated basket capacity shall be 0.17 gallons. Perforated basket shall have the ability to be maintained via side access. Perforated basket shall have clear face to allow visibility into unit.

4. Interceptor shall be furnished with a top inlet and triple outlet option, field-adaptable for 1-1/2" or 2" drain line pipe size.

5. Interceptor shall be certified to IAPMO IGC 167-2011ae2 and carry a UPC listing.

2.12 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Manufacturers:

a. Acorn Controls: www.acorncontrolvalves.com

b. Powers: www.powerscontrols.com.

c. Caleffi; www.caleffi.com/usa/en-us

d. Watts: www.watts.com

e. Zurn: www.zurn.com

f. Substitutions: See Section 016000 - Product Requirements.

2. Point of Use Mixing Valve:

a. The Thermostatic Mixing Valve shall be IAPMO lab certified to ASSE 1069, ASSE 1070 and CSA B125.3 standards and capable of meeting the control accuracy requirements of these standards at the manufacturer's listed minimum flow rates.

b. Valve shall have an adjustable outlet temperature range of 90°F-115°F (32°C-46°C), factory set at 105°F (41°C).

c. Valve shall be a solid brass body with a capacity of 12 GPM (45 LPM) at 45 PSI (310 kPa) differential and a maximum operating pressure of 125 PSIG (862 kPa). Supply pressure variation shall be up to 20%.

d. Valve shall contain a copper encapsulated, paraffin-based thermal actuator.

2.13 PUMP CONNECTORS

A. Manufacturers:

1. Twin City Hose: www.twincityhose.com

2. Metraflex: www.metraflex.com

3. FlexHose: www.flexhose.com

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Flexible Connectors: Braided type with wetted components or stainless steel or bronze, sized to match piping. Materials of construction shall be consistent with pipe material and equipment/pipe connection fittings. Flexible hose connectors shall be capable of compensating for lateral movement and vibrations.

C. NSF 61 listed for potable water use.

D. End connections: Same as specified for pipe jointing. Copper fittings shall not be attached to stainless steel hose.

2.14 AIR VENTS

A. Manufacturers:

1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.

2. ITT Bell & Gossett: www.bellgossett.com/#sle.

3. Taco, Inc: www.taco-hvac.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

2.15 FLOOR DRAIN TRAP SEALS

A. Manufacturers:

1. MIFAB, Inc: www.mifab.com/#sle.

2. JR Smith: www.jrsmith.com.

3. Zurn: www.zurn.com

4. Rectorseal / Sure Seal: www.rectorseal.com

5. Substitutions: See Section 016000 - Product Requirements.

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane. For use in floor drain outlets or the adjustable strainer throats to minimize evaporation of the trap seal.

C. Standard: Required flow rates per ASSE 1072.

D. Size: To match floor drain in which protection device is to be installed

E. Do not use in applications where the room/space has atmospheric pressure less than ambient pressure of the exterior of the room/space or building

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate clean-out locations with Architect prior to installation.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

G. Pipe relief from backflow preventer to nearest drain.

H. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to fixtures or devices with quick closing valves; to include flushvalves, dishwashers, washing machines, etc. All branches serving flushvalves shall be provided with water hammer arrestors installed in compliance with manufacturer recommendations.

SECTION 221123
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Circulators.

1.2 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2023.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide certified pump curve with duty point marked over pump and system operating conditions and NPSH curve and power requirement by pump tag.

2. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

C. Shop Drawings: Include dimensions and performance data.

D. Test Reports: Plumbing fixture operational tests.

1.5 QUALITY ASSURANCE

A. Certifications: Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc, as suitable for purpose specified and indicated.

B. Identification: Provide pumps with manufacturer's name, model number, and rated capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for pumps except circulator type. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty for circulators. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 CIRCULATORS

A. Manufacturers:

1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.

2. Bell & Gossett, a Brand of Xylem, Inc: www.xylem.com/#sle.

3. Grundfos Pumps Corporation: www.grundfos.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Large Inline Circulator with EC Motor:

1. The pumps shall be a wet rotor inline pump, lead free bronze body construction specifically designed for quiet operation. Suitable standard operations at 230° F and 175 PSIG working pressure. The pump internals shall be capable of being serviced without disturbing piping connections.

2. The pump internals shall be capable of being serviced without disturbing piping connections.

3. Pump shall be equipped with a water-tight seal to prevent leakage.

4. Pump volute shall be of a cast iron design for heating systems or lead free bronze for domestic water systems. The connection style on the cast iron and bronze pumps shall be flanged.

5. Motor shall be a synchronous, permanent-magnet (PM) motor and tested with the pump as one unit. Conventional induction motors will not be acceptable.

6. Each motor shall have an Integrated Variable Frequency Drive tested as one unit by the manufacturer.

7. Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).

8. Pump shall have BACnet connections built into the VFD as standard options.

9. Pumps shall be UL 778 listed and bear the UL Listed Mark for USA and Canada with on-board thermal overload protection.

10. Pump integral controls shall allow for proportional pressure or constant temperature operating mode to vary the speed of the pump in order to maintain a differential pressure based on flow demand or constant temperature of the fluid media. Refer to schedule on plans for which operating mode is desired for this project.

11. Pump controls shall allow for Alternate Operation for 2 pump system such that only one pump runs at a time. The working time is switched every 24 hours.

C. Performance: Refer to Schedules.

D. Notify engineer upon start-up and comissioning of pumps to ensure proper setpoints are used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products with related fittings, and accessories according to manufacturer instructions.

B. Provide for the service of a competent factory-trained supervising agent from the equipment manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.

C. Potable and Drinking Water Service: Provide NSF 61 certified; comply with ICC (IPC).

D. Electrical-Driven Pump Work:

1. Provide electric-motor-driven equipment specified complete with local disconnect switch and control panel with starter, controls, safety devices, and related wiring.

2. Provide automatic control and protective devices field-wired to interface-related devices required for specified operation.

E. Ensure that small pressure gauges are installed on both upstream and downstream ends.

F. Hot Water Service: Ensure that small pressure-temperature gauges are installed on both upstream and downstream ends.

G. Factory-Provided Pump Controls: Factory provided, tested for use.

H. ECM, VSD, or VFD Controlled Motors: Configure unit to operate within manufacturer-listed pump curve points unless factory set to do so. Then adjust to operate in automatic to maintain downstream pressure setpoint.

I. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

J. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.

K. Provide temperature and pressure gauges where and as detailed or directed.

L. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any load or stress being applied to the connections or piping.

M. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instruction and per applicable state, federal, and local codes.

N. Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the control's contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.

O. Power and control wiring shall run in separate channel.

P. Pumps that are supplied with an integrated VFD and should not be used with any external VFDs.

Q. Pumps shall NOT be run dry to check rotation.

R. Floor Mounted Equipment:

1. Install the system level and in accordance with manufacturer's published recommendations.

2. Locate equipment with allowance for manufacturer's recommended clearances around unit.

3. Set entire unit on 4" high reinforced concrete equipment pad.

4. Pipe discharge from all relief valves, drains and individual pump thermal purge protection solenoid valves, indirectly to floor drain having adequate capacity to accept discharge.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.3 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.4 PROTECTION

A. Protect installed products from damage due from subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

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SECTION 223000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial gas-fired water heaters.

B. Commercial electric water heaters.

C. Expansion tanks.

D. Water filters.

E. Condensate removal pumps.

F. Domestic, storm, and sanitary-sewage pumps.

1.2 RELATED REQUIREMENTS

A. Section 221123 - Domestic Water Pumps.

B. Section 221329 - Sanitary Sewerage Pumps.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less; 2019, with Errata (2020).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

E. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Provide electrical characteristics and connection requirements.

C. Project Record Documents: Record actual locations of components.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Water Softener Salt: 50 pounds.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:

1. All products in contact with potable water: NSF approved.

2. Indirect-Fired Gas Water Heaters: AHRI Directory of Certified Product Performance.

3. Electric Water Heaters: UL listed and labeled to UL 174.

4. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.

5. Water Tanks: ASME labeled to ASME BPVC-VIII-1.

6. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co: www.hotwater.com/#sle.

2. PVI: www.pvi.com/#sle.

3. Bradford White Corporation: www.bradfordwhite.com/#sle.

4. Lochinvar: www.lochinvar.com/#sle.

5. Bock: www.bockwaterheaters.com

6. Substitutions: See Section 016000 - Product Requirements.

B. Performance:

1. The water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 standard.

2. The water heater's efficiency shall be verified through third party testing by AHRI and listed in the AHRI Certification Directory.

3. Minimum hot water storage temperature shall be 140 degrees F, unless otherwise noted on Schedules.

C. Commercial Gas-Fired Water Heaters:

1. Type: Automatic, natural gas-fired, vertical storage.

2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.

3. Performance: Refer to Schedules.

4. Tank: Glass-lined, welded steel, ASME labeled; multiple flue passages, 4-inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

5. Accessories:

a. Water Connections: Brass.

b. Dip Tube: Brass.

c. Drain valve.

d. Anode: Magnesium.

e. Temperature and Pressure Relief Valve: ASME labeled.

f. Condensate neutralizer, as required.

6. Applications:

a. Automatic storage water heater.

7. Controls: The water heater shall feature a SMART Control with an LCD display with soft key pad. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All electronic circuitry shall be easily accessed and serviceable from the front of the jacket.

D. Residential Electric:

1. Type: Automatic, electric, vertical storage.

2. Performance: Refer to Schedules.

3. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.

4. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.

5. Accessories:

a. Water Connections: Brass.

b. Dip Tube: Brass.

c. Drain valve.

d. Anode: Magnesium.

e. Temperature and Pressure Relief Valve: ASME labeled.

2.2 DOMESTIC HOT WATER STORAGE TANKS

2.3 EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com/#sle.

2. Wessels: www.westank.com/#sle

3. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Tank:Tank shall have a Deep-Drawn steel shell with no longitudinal welds or "T" joints. The tank shall be constructed, tested and stamped in accordance with Section VII, Division 1 of the ASME Code. All welds to conform to ASME Section IX. Tanks shall carry NSF Standard 61 and IAPMO Lead-Free listings.

C. Diaphragm: A Butyl rubber diaphragm shall be affixed to the pressure shell via a circumferentially grooved seal.

D. Antimicrobial Chamber: The internal water chamber shall include a molded Polypropylene liner with a silver-ion based Antimicrobial compound; tested to Standard JIS Z 2801 for efficacy in the reduction of Legionella (L. pneumophila). Staphylococcus (S. aureus) and Coliform (E. coli) bacteria on its surface.

E. Connection: The water connection shall be 304L Stainless Steel with a Turbulator circulation device inserted to encourage reduction of stagnant water within the tank water chamber.

F. Accessories: Pressure gauge and air-charging fitting, tank drain. Contractor shall field adjust pre-charge after field verification of incoming service pressure to hot water system.

2.4 CONDENSATE REMOVAL PUMPS

A. Manufacturers:

1. Franklin Electric Company: www.franklin-electric.com/#sle.

2. Liberty Pumps Inc: www.libertypumps.com/#sle.

3. Little Giant: www.littlegiant.com

4. Sauermann Pumps: www.sauermannpumps.com

5. Substitutions: See Section 016000 - Product Requirements.

B. For Non-Plenum Applications:

1. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch with automatic start/stop operation, built-in high-level water safety switch, thermoplastic reservoir, motor assembly, and 6 ft power cord with ground.

2. Safety: UL 778.

C. For Plenum Applications:

1. Construction: Commercial grade with stainless steel shaft, check valve, integral float switch with automatic start/stop operation, built-in high-level water safety switch, thermal overload protection; pump shall be labaled suitable for use in air handling spaces, designed for hard wire installation only.

D. Overflow safety switch shall include low voltage contacts for equipment shut down connection (by Temperature Controls Contractor).

E. Provide with insulation sleeve where applicable.

F. Performance: Refer to Schedules.

2.5 DOMESTIC, STORM, AND SANITARY-SEWAGE PUMPS

A. Domestic Water Pumps: See Section 221123.

B. Sump Pumps: See Section 221329.

C. Sanitary Sewerage Pumps: See Section 221429.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.

C. Provide for the service of a competent factory-trained supervising agent from the equipment manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.

D. Notify engineer upon start-up and comissioning of pumps to ensure proper setpoints are used.

E. Pipe cooled condensate produced by the combustion process from the water heater condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

F. Domestic Water Storage Tanks:

1. Provide steel pipe support, independent of building structural framing members.

2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

G. Floor Mounted Equipment:

1. Install the system level and in accordance with manufacturer’s published recommendations.

2. Locate equipment with allowance for manufacturer's recommended clearances around unit.

3. Set entire unit on 4" high reinforced concrete equipment pad.

4. Pipe discharge from all relief valves, drains and individual pump thermal purge protection solenoid valves, indirectly to floor drain having adequate capacity to accept discharge.

SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush valve water closets.

B. Wall hung urinals.

C. Lavatories.

D. Wall-hung, solid surface, multistation lavatory units.

E. Sinks.

F. Shower receptors.

G. Showers.

H. Bi-level, electric water coolers.

I. Service sinks.

1.2 RELATED REQUIREMENTS

A. Section 011000 - Summary: Owner-furnished fixtures.

B. Section 221005 - Plumbing Piping.

C. Section 221006 - Plumbing Piping Specialties.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.

F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

H. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.

I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

K. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

L. NSF 61 - Drinking Water System Components - Health Effects; 2023.

M. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Faucet Washers: Two sets of each type and size.

3. Extra Toilet Seats: One of each type and size.

4. Flush Valve Service Kits: One for each type and size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler refrigerantion system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Perform work in accordance with local health department regulations.

2.3 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung or floor mounted as indicated on Schedules, siphon jet flush action, china bolt caps.

1. Flush Valve: Exposed (top spud).

2. Flush Operation: Refer to Schedules.

3. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Kohler Company: www.kohler.com/#sle.

c. Zurn Industries, Inc: www.zurn.com/#sle.

d. Sloan: www.sloan.com.

e. Substitutions: See Section 016000 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.

1. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Sloan Valve Company: www.sloanvalve.com/#sle.

c. Zurn Industries, Inc: www.zurn.com/#sle.

d. Kohler Company: www.kohler.com/#sle.

e. Substitutions: See Section 016000 - Product Requirements.

2. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

C. Toilet Seats:

1. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Bemis Manufacturing Company: www.bemismfg.com/#sle.

c. Church Seat Company: www.churchseats.com/#sle.

d. Centoco: www.centoco.com

e. Zurn Industries, Inc: www.zurn.com/#sle.

f. Manufacturer of Closet Bowl.

g. Substitutions: See Section 016000 - Product Requirements.

2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers For Wall Hung Closets:

1. Manufacturers:

a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.

b. JOSAM Company: www.josam.com/#sle.

c. Zurn Industries, Inc: www.zurn.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.4 WALL HUNG URINALS

A. Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com/#sle.

2. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.

3. Kohler Company: www.kohler.com/#sle.

4. Zurn Industries, Inc: www.zurn.com/#sle.

5. Sloan: www.sloan.com.

6. Substitutions: See Section 016000 - Product Requirements.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.

1. Flush Valve: Exposed (top spud).

2. Flush Operation: Refer to Schedules.

3. Trapway Outlet: Integral.

C. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.

1. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Sloan Valve Company: www.sloanvalve.com/#sle.

c. Zurn Industries, Inc: www.zurn.com/#sle.

d. Kohler Company[<>]: www.kohler.com/#sle.

e. Substitutions: See Section 016000 - Product Requirements.

D. Urinal Carriers:

1. Manufacturers:

a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.

b. JOSAM Company: www.josam.com/#sle.

c. Zurn Industries, Inc: www.zurn.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.5 LAVATORIES

A. Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com/#sle.

2. Kohler Company: www.kohler.com/#sle.

3. Zurn Industries, Inc: www.zurn.com/#sle.

4. Sloan: www.sloan.com.

5. Substitutions: See Section 016000 - Product Requirements.

B. Vitreous China Basin: ASME A112.19.2; vitreous china wall hung or counter-top mounted as indicated on Schedules, with overflow.

C. Supply Faucet:

1. Deck Mounted Faucet Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Kohler Company: www.kohler.com/#sle.

c. Zurn Industries, LLC: www.zurn.com/#sle.

d. Symmons: www.symmons.com

e. Speakman: www.speakman.com

f. Delta Faucet: www.deltafaucet.com

g. Sloan: www.sloan.com

h. Substitutions: See Section 016000 - Product Requirements.

2. ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gpm, ADA compliant handles.

D. Carrier for Wall Mounted Lavatories:

1. Manufacturers:

a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

b. JOSAM Company: www.josam.com/#sle.

c. Zurn Industries, LLC: www.zurn.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

3. Provide carrier with integral clearance for piping as required for installation as shown on plans.

E. Accessories:

1. Offset waste with perforated open strainer.

2. Lavatory P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2” water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer’s name. No private label wholesale products will be allowed.

a. Part # McGuire 8902C

3. Screwdriver stops.

4. Rigid supplies.

5. All exposed lavatory and sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.

   a. Part #McGuire PW2150WC

6. Install with point of use thermostatic mixing valve. Refer to Section 22 1006.

2.6 WALL-HUNG, SOLID SURFACE, MULTISTATION LAVATORY UNITS

A. Manufacturers:

1. Zurn Industries, LLC: www.zurn.com/#sle.

2. Bradley Corp.<>: www.bradleycorp.com/#sle..

3. Substitutions: See Section 016000 - Product Requirements.

B. Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.

C. Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-based polyester resin and meeting requirements of IAPMO Z124.

D. Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.

E. Number of Wash Stations: Refer to Schedules.

F. Soap Dispenser:

G. Water Supply: Thermostatic mixing valve assembly.

H. Color: As selected by Architect from manufacturer's full line.

I. Sensor-Operated Faucets:

1. Manufacturers:

   a. By sink manufacturer

   b. Sloan

   c. Bradley

   d. Substitutions: See Section01 6000-Product Requirements.

2. High profile metering faucet with infrared and external temperature control.

3. Vandal-resistant meeting requirements of ASME A112.18.1 and ADA Standards compliant.

4. Body: Polished, chrome-plated commercial solid cast brass, with 4 inch (102 mm) centerset mounting with anti-rotation trim plate.

5. Tempered Water Supply: ADA Standards compliant lever on faucet body.

6. Aerator: Flow rate of 0.5 gpm at 20 to 80 psi operating range.

7. Sensor Module: Water conserving, vandal-resistant adjustable sensor unit with timing turn-off delay and stationary object automatic timed cutoff, with battery diagnostic light, serviceable from above deck.

8. Power Supply: 6 VDC lithium battery and single 115 VAC plug-in adapter.

J. Access Panel: Stainless steel.

K. Support Frame: Wall-mounted, heavy gauge, stainless steel.

L. Manufacturers:

1. Acorn Engineering Company: www.acorneng.com/#sle.

2. Bradley Corporation: www.bradleycorp.com/#sle.

3. Sloan: www.sloan.com.

4. Substitutions: See Section 016000 - Product Requirements.

2.7 SINKS

A. Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com/#sle.

2. Elkay: www.elkay.com.

3. Just Manufacturing: www.justmfg.com

4. Substitutions: See Section 016000 - Product Requirements.

B. General: ASME A112.19.3, stainless steel, self rimming and undercoated.

C. Bowl Quantity and Size: Refer to Schedules.

D. Faucet:

1. Gooseneck faucet with ADA wristblade handles

2. Flowrate: Refer to Schedules.

3. Manufacturers:

    a. Kohler Company: www.kohler.com/#sle.

    b. Chicago Faucet: www.chicagofaucets.com

    c. Delta Faucet: www.deltafaucet.com

    d. Substitutions: See Section01 6000-Product Requirements.

E. Accessories:

1. Drain:

    a. Removable basket strainer.

2. Sink P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2” water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer’s name. No private label wholesale products will be allowed.

    a. Part # McGuire 8902C

3. Screwdriver, Loose key stops.

4. Sink supply kits shall include chrome plated all brass stops with brass stems, no plastic stems. Kits shall have 12” chrome plated copper risers and shallow brass flange. Inlet shall be ½” compression and outlet shall be 3/8” compression. Supply kit shall be certified by recognized independent third-party testing authority, will be marked with the manufacturer’s name and comply with the SDWA (Safe Drinking Water Act) “No Lead” restrictions of ANSI NSF 61, Sec. 9. No private label wholesale products will be allowed.

    a. Part #McGuire LFBV2165CC

5. All exposed sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.

    a. Part #McGuire PW2150WC

6. Install with point of use thermostatic mixing valve, where noted in Schedules or where fixture must be ADA compliant. Refer to Section 22 1006.

2.8 SHOWERS

A. Shower Trim:

1. Single Handle: ASME A112.18.1; lever-handle operated, pressure balanced mixing valve with integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum flow, and escutcheon.

B. Shower Valve:

1. Comply with ASME A112.18.1 and ASSE 1016.

2. Provide in wall diverter valve body with integral thermostatic mixing valve to supply shower head.

3. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. DXV by American Standard, Inc: www.dxv.com/#sle.

c. Grohe America, Inc: www.grohe.com/us/#sle.

d. Acorn Controls: www.acorncontrolvalves.com

e. Symmons

f. Substitutions: See Section 016000 - Product Requirements.

C. Shower Head:

1. ASME A112.18.1; chrome plated head with integral wall bracket, built-in flow control.

2. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. DXV by American Standard, Inc: www.dxv.com/#sle.

c. Grohe America, Inc: www.grohe.com/us/#sle.

d. Symmons

e. Substitutions: See Section 016000 - Product Requirements.

D. Hand-Held Shower Head:

1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting with ASSE 1014 backflow preventer.

2. Include 60 inch minimum flexible polished stainless steel hose and in-line vacuum breaker

3. Provide grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.

4. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. DXV by American Standard, Inc: www.dxv.com/#sle.

c. Grohe America, Inc: www.grohe.com/us/#sle.

d. Symmons

E. Pressure Balancing Valve:

1. ASME A112.18.1, cast bronze, 6.3 gpm, rough-in ceramic disc cartridge shower and tub valve with sweat connections.

2.9 BI-LEVEL, ELECTRIC WATER COOLERS

A. Manufacturers:

1. Elkay Manufacturing Company: www.elkay.com/#sle.

2. Haws Corporation: www.hawsco.com/#sle.

3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.

4. Oasis International: www.oasiscoolers.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Water Cooler: Bi-level, electric, mechanically refrigerated; mounting as specified on Schedules , ADA compliant; elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser.

1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.10 MOP SINKS

A. Manufacturers:

1. Just Manufacturing Company: www.justmfg.com/#sle.

2. Zurn Industries, Inc: www.zurn.com/#sle.

B. Terrazzo Mop Sink Manufacturers:

1. Just Manufacturing Company: www.justmfg.com/#sle.

2. Zurn Industries, Inc: www.zurn.com/#sle.

3. Fiat: www.fiatproducts.com.

C. Material: Precast terrazzo composed of marble chips cast in Portland cement.

D. Type: Rectilinear, standard height.

E. Dimensions: As indicated on drawings.

F. Accessories:

1. Hose clamp hanger.

2. Mop hanger.

2.11 SERVICE OR UTILITY SINKS

A. Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com/#sle.

2. Elkay Manufacturing Company: www.elkay.com/#sle.

3. Just Manufacturing Company: www.justmfg.com/#sle.

4. Fiat: www.fiatproducts.com.

5. Substitutions: See Section 016000 - Product Requirements.

B. Self-Standing, Single Bowl, Laundry Sink: 2-hole, white finished, composite bowl, 20 gal capacity with fitted drain and stopper. Size as indicated on drawings.

C. Trim: ASME A112.18.1 exposed wall type supply, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Two-Lever Handle Service Faucet:

1. Type: Wall-mount spout faucet with union inlets and mounting plate.

2. Spray Type: Full stream spray at 1.8 gpm, maximum.

3. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.

4. Materials: Ceramic disc cartridge valve on brass body with polished chrome finish.

E. Accessories:

1. Hose clamp hanger.

2. Mop hanger.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

D. Examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

E. Inspect fixtures and accessories that are to be removed and relocated. Damaged or blemished items shall be brought to Architect's/Engineer's attention before reinstalling.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide supplies to fixtures with stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Piping exposed to view shall be chrome plated.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Adjust or replace washers to prevent leaks at faucets and stops.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.8 FEILD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

SECTION 230005
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. This section applies to all sections of Division 23.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.2 APPLICATION

A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.

B. The mechanical contractor is responsible for the installation and operation of the hvac systems and temperature control systems.

C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.3 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.4 ALTERNATES AND SUBSTITUTIONS

A. Refer to Division 01 - General Requirements for procedures.

1.5 DEVIATION FROM BASIS OF DESIGN MANUFACTURER

A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.6 MATERIALS

A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22, and 23 of these specifications, including all wiring devices, conduit, etc.

C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.7 DRAWINGS

A. The drawings are diagrammatic and show the general location and arrangement of all equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. The mechanical and electrical contractor shall check all documents including architectural, structural, plumbing, HVAC and electrical to avert possible installation conflicts. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

E. Do not scale drawings for measurements.

F. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.

G. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started

H. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

I. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.

1.8 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 23 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.9 MAINTENANCE

A. Provide 40 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.

B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.10 WARRANTY AND GUARANTEE

A. Contractor shall guarantee all work installed by themselves or their subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.11 SUBMITTALS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (hvac equipment, piping equipment, etc.). Refer to other sections of the mechanical specifications for additional requirements.

C. Engineer WILL NOT REVIEW:

1. Submittals not specified.

2. Submittals not reviewed by Contractor, including Contractor stamp with signature comments.

3. Submittals made after work is delivered to site and/or installed.

4. Submittal resubmissions unless resubmission is required by Architect/Engineer.

D. Types of submittals include the following:

1. Shop Drawings

2. Product Data Sheets

3. Samples

4. Manufacturers Instructions

5. Maintenance Data

6. Warranty

E. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.

F. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

1.12 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:

1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.

2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

C. Record drawings shall be maintained by the contractor up to date as the project progresses.

D. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

1.13 QUALITY ASSURANCE

A. Other referenced standards:

1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

PART 2 PRODUCTS

2.1 SLEEVES AND ESCUTCHEONS

A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.2 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.3 FILTERS

A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

2.4 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS

A. General Requirements:

1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.

2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.

3. If specially designed building attachments are required, retain the services of a licenced structural engineer to design such building attachments.

4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.

5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:

1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.

a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.

b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:

1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:

1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

2. Manufacturers: Hilti

PART 3 EXECUTION

3.1 GENERAL

A. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.

B. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.

C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.

D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.2 ACCESSIBILITY

A. Do not locate valves, traps, controls, unions, dampers, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

3.3 ACCESS DOORS AND PANELS

A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.

B. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

C. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.

3.4 CUTTING AND PATCHING

A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.

B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.

C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.5 ROUGH-IN FOR CONNECTION TO EQUIPMENT

A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.6 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.7 SEAL PENETRATIONS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.8 SOUND CONTROL

A. Penetrations shall be maintained airtight to prevent sound transfer.

B. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.9 FIRESTOPPING

A. Refer to Division 07 - Thermal and Moisture Protection for more information.

B. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.10 DELIVERY, STORAGE AND HANDLING OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

C. Contractor shall provide temporary protection for installed equipment prior to project completion.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.

F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

G. Protect dampers, grilles, louvers from damage to operating linkages and blades.

3.11 CLEANING

A. Refer to Division 01 - General Requirements; all mechanical equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

3.12 CONTROL WIRING

A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

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SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

1.2 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.

2. Provide sealant for watertight joint.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

E. Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.

3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.1 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.

2. Aboveground Piping:

a. Pack solid using mineral fiber in compliance with ASTM C592.

b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

E. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Extra Pressure Gauges: One of each type and size.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

3. Omega Engineering, Inc: www.omega.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.

2. Size: 4-1/2 inch diameter.

3. Mid-Scale Accuracy: One percent.

4. Scale: Psi and KPa.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

2. Omega Engineering, Inc: www.omega.com/#sle.

3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.

2. Window: Clear Lexan.

3. Stem: 3/4 inch NPT brass.

4. Accuracy: 2 percent, per ASTM E77.

5. Calibration: Degrees F.

2.4 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs where indicated; coordinate with Temperature Controls Contractor and Test and Balance Contractor for any additional locations needed to complete their work.

3.2 SCHEDULE

A. Pressure Gauges, Location:

1. Pumps.

2. Expansion tanks.

3. Bypass/side-stream filters.

B. Pressure Gauge Tappings, Location:

1. Control valves 3/4 inch & larger - inlets and outlets.

2. Major coils - inlets and outlets.

3. Chiller - inlets and outlets.

4. Boiler - inlets and outlets.

C. Stem Type Thermometers, Location:

1. Headers to central equipment.

2. Boilers - inlets and outlets.

3. Chiller - inlets and outlets.

4. After major coils.

5. As noted on plans, diagrams and details.

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Butterfly valves.

E. Check valves.

F. Combination flow measuring and balancing valves.

1.2 RELATED REQUIREMENTS

A. Section 230553 - Identification for HVAC Piping and Equipment.

B. Section 230719 - HVAC Piping Insulation.

C. Section 232113 - Hydronic Piping.

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. PTFE: Polytetrafluoroethylene.

E. SWP: Steam working pressure.

F. TFE: Tetrafluoroethylene.

1.4 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.

H. ASME B31.9 - Building Services Piping; 2020.

I. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

J. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.

K. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

L. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

M. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

N. AWWA C606 - Grooved and Shouldered Joints; 2022.

O. MSS SP-45 - Drain and Bypass Connections; 2020.

P. MSS SP-67 - Butterfly Valves; 2022.

Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

R. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

S. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:

1. Throttling (Hydronic): Combinations and Flow Measuring.

2. Isolation (Shutoff): Butterfly and Ball.

3. Pump Outlet: Spring Loaded Check.

4. Dead-End: Butterfly, single-flange (lug) type.

5. Drain Valve: Ball with hose end connection and cap.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types: Use flanges, unions or grooved couplings to allow disconnection of components for servicing.

D. Hydronic Valves:

1. 2 NPS and Smaller, Bronze or Hot Forged Brass Valves.

2. 2-1/2 NPS and Larger, Cast Steel Valves or Butterfly Valves.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Gear Actuator: Quarter-turn valves 8 NPS and larger.

2. Handwheel: Valves other than quarter-turn types.

3. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

2. Butterfly Valves: Extended neck.

3. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.

2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.

3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.

4. Solder Joint Connections: ASME B16.18.

5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.

2. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:

1. Fabricate from dezincification resistant material.

2. Hot Forged Brass is an approved material from Bonomi only.

3. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE BALL VALVES

A. Two Piece, Full Port with brass Trim:

1. Comply with MSS SP-110.

2. SWP Rating: 150 psig.

3. CWP Rating: 600 psig.

4. Body: Bronze.

5. Ends: Solder or threaded with union.

6. Seats: PTFE .

7. Stem: Bronze or brass.

8. Ball: Chrome plated brass.

9. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Bonomi North America www.bonominorthamerica.com

c. Tyco Flow Control: www.tycoflowcontrol.com

d. Grinnel Products: www.grinnel.com

e. Victaulic Company: www.victaulic.com

f. Milwaukee Valve Company: www.milwaukeevalve.com

g. Kitz Corporation of Ameria.

h. Jomar Valves: www.jomarvalve.com

i. Nibco Valves

j. Substitutions: See Section 016000 - Product Requirements.

2.4 CARBON STEEL BALL VALVES

A. Class 300, Full Port, Stainless Steel Trim:

1. Comply with MSS SP-72.

2. CWP Rating: 285 psig.

3. Body: Carbon steel, ASTM A216/A216M, Type WCB.

4. Ends: Flanged.

5. Seats: PTFE.

6. Stem: Stainless steel.

7. Ball: Stainless steel, vented.

8. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Bonomi North America www.bonominorthamerica.com.

c. Tyco Flow Control: www.tycoflowcontrol.com

d. Grinnel Products: www.grinnel.com

e. Victaulic Company: www.victaulic.com

f. Milwaukee Valve Company: www.milwaukeevalve.com

g. Kitz Corporation of Ameria.

h. Jomar Valve: www.jomarvalve.com

i. Substitutions: See Section 016000 - Product Requirements.

2.5 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.

1. Comply with MSS SP-67, Type I.

2. CWP Rating: 150 psig.

3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.

4. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

5. Seat: replaceable EPDM.

6. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

7. Operator: 10 position lever handle.

8. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Tyco Flow Control: www.tycoflowcontrol.com.

c. ABZ Valves and Controls.

d. Hammond Valve: www.hammondvalve.com

e. Grinnel Products: www.grinnel.com

f. Pratt Industrial www.prattindl.com

g. Victaulic Company: www.victaulic.com

h. Jomar Valve: www.jomarvalve.com

i. Substitutions: See Section 016000 - Product Requirements.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).

1. Comply with MSS SP-67, Type I.

2. Body: Coated ductile iron.

3. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

4. Disc: Coated ductile iron.

5. Disc Seal: replaceable EPDM.

6. Operator: 10 position lever handle.

7. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Bonomi North America www.bonominorthamerica.com

c. Tyco Flow Control: www.tycoflowcontrol.com.

d. ABZ Valves and Controls.

e. Hammond Valve: www.hammondvalve.com

f. Grinnel Products: www.grinnel.com

g. Victaulic Company: www.victaulic.com

h. Substitutions: See Section 016000 - Product Requirements.

2.7 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).

1. Comply with MSS SP-80, Type 3.

2. Body Design: Horizontal flow.

3. Body Material: Bronze, ASTM B62.

4. Ends: Soldered.

5. Disc: Bronze.

6. Manufacturers:

a. Apollo Valves: www.apollovalves.com/#sle.

b. Grinnell Products: www.grinnell.com.

c. Kitz Corporation of America.

d. Tyco Flow Control: www.tycoflowcontrol.com

e. Victaulic Company: www.victaulic.com

f. Substitutions: See Section 016000 - Product Requirements.

2.8 BRONZE SPRING LOADED CHECK VALVES

A. Class 125: CWP Rating 200 psig (1380 kPa).

1. Design: Vertical flow.
2. Body: Bronze, ASTM B61 or ASTM B62
3. Spring: Bronze
4. Ends: Threaded or soldered as indicated.
5. Disc: Nonmetallic
6. Manufacturers:
   a. Milwaukee: www.milwaukeevalve.com
   b. Apollo Valves[<>]: www.apollovalves.com/#sle.
   c. Bonomi www.bonominorthamerica.com Hot Forged Brass Material approved
   d. Substitutions: See Section01 6000-Product Requirements.

2.9 IRON, FLANGED END SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) with Nonmetallic-to-Metal Seats.
   1. Comply with MSS SP-71, Type I.
   2. Design: Clear or full waterway with flanged ends.
   3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
   4. Trim: Bronze.
   5. Disc: Stainless steel, bronze, or bronze faced rotating swing. Renewable disc and seat.
   6. Gasket: Asbestos free.

B. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Bonomi North America www.bonominorthamerica.com
   3. Ferguson Enterprises Inc: www.fnw.com/#sle.
   4. Grinnel Products: www.grinnell.com.
   5. Kitz Corporation of America.
   6. Tyco Flow Control: www.tycoflowcontrol.com
   7. Victaulic Company: www.victaulic.com
   8. Titan Flow: www.titanfci.com

9. Substitutions: See Section 016000 - Product Requirements.

2.10 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP:

1. Body Material: ASTM A536, Grade 65-45-12 ductile iron.

2. Seal: EPDM or Nitrile.

3. Disc: Stainless steel.

4. Coating: Black, non-lead paint.

5. Manufacturers:

a. Grinnel Products: www.grinnell.com.

b. Kitz Corporation of America.

c. Tyco Flow Control: www.tycoflowcontrol.com

d. Victaulic Company: www.victaulic.com

e. Titan Flow: www.titanfci.com

f. Substitutions: See Section 016000 - Product Requirements.

2.11 IRON, PLATE-TYPE, SPRING LOADED CHECK VALVES

A. Class 125 Dual-Plate:

1. Comply with API STD 594.

2. 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.

3. Body Design: Wafer or threaded lug ends, spring-loaded plates.

4. Body Material: ASTM A126, gray iron.

5. Trim: Bronze.

6. Resilient Seat: EPDM.

7. Spring: Stainless steel.

8. Manufacturers:

a. Tyco Flow Control: www.tycoflowcontrol.com.

b. Bonomi North America www.bonominorthamerica.com

c. Crane Co.: www.cranevalve.com

d. Kitz Corporation of America.

e. Victaulic Company: www.victaulic.com

f. Titan Flow: www.titanfci.com

g. Substitutions: See Section 016000 - Product Requirements.

2.12 COMBINATION FLOW MEASURING AND BALANCING VALVE

A. Manufacturers:

1. Griswold Controls

2. Nexus

3. Flow Design

B. Construction:

1. Manual Flow Control devices shall be fixed orifice venturi, modified venturi, or pitot balancing type accurate to at least +/- 3%.

2. Valves 2-1/2" and smaller shall be modified venturi style, forced brass body and with integrated ball valve, (2) pressure/temperature test ports, additional port for air vent or drain valve, a tag indicating the model and Cv, memory stop with graduated scale, blowout proof stem with dual O-ring seals, interchangeable union end with O-ring seal, hard chrome plated ball with Teflon seats, and rated at 600 PSI WOG, 325 degrees F.

3. Valves 2-1/2" and larger shall be venturi or pitot balancing type accurate to at least +/- 3%.

a. Venturi balancing type shall be a flanged carbon steel ST37 body (per ASME B16.5, Class 150 Flanges); butterfly valve with infinite position memory stop and 316 stainless steel disc. Valve shall have (2) 1/4" NPT ports and be rated for 230 PSI, 250 degrees F.

b. Pitot tube balancing type shall be flanged cast iron body (per ASTM A126, Class B Flanges) metering station with stainless steel pitot tube; a tag indicating the model and Cv; butterfly valve with infinite position memory stop and 316 stainless steel disc. Valve shall have a minimum, (2) 1/4" NPT ports, (1) 1/2" NPT port and (1) additional 3/4" NPT port. Valve shall be rated at 175 PSI, 275 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install valves with stems upright or horizontal, not inverted.

D. Install check valves where necessary to maintain direction of flow as follows:

1. Swing Check: Install horizontal maintaining hinge pin level.

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SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

2. Brady Corporation: www.bradycorp.com.

3. Champion America, Inc: www.champion-america.com.

4. Substitutions: See Section 016000 - Product Requirements.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

2.2 TAGS

A. Manufacturers:

1. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

2. Brady Corporation: www.bradycorp.com.

3. Champion America, Inc: www.champion-america.com.

4. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.3 PIPE MARKERS

A. Manufacturers:

1. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

2. Brady Corporation: www.bradycorp.com.

3. Champion America, Inc: www.champion-america.com.

4. Substitutions: See Section 016000 - Product Requirements.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with nameplates. Small devices, such as inline pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with nameplates.

G. Identify thermostats relating to terminal boxes or valves with nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Where piping is exposed to the space (i.e. no ceiling), install markers on the underside of piping to ensure visibility to occupants below.

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SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 RELATED REQUIREMENTS

A. Section 23 0005 - Basic HVAC Requirements.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; 2019.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit six weeks prior to starting the testing, adjusting, and balancing work.

2. Include at least the following in the plan:

a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

d. Final test report forms to be used.

e. Details of how TOTAL flow will be determined; for example:

1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

f. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

g. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner and Engineer and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

6. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.

b. Address of Testing, Adjusting, and Balancing Agency.

c. Telephone number of Testing, Adjusting, and Balancing Agency.

d. Project name.

e. Project location.

f. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. Approved TAB Agencies:

1. Enviro-Aire. 586.779.6200; https://enviro-aire.com

2. Controls Solutions Inc. (CSI). 616.247.9422; https://controlyourbuilding.com

3. Environmental Testing Services. 248.859.6100; https://www.etsmi.com.

4. Integrity Test and Balance, Inc. 231.929.0940

5. International Test and Balance, Inc. 248.559.5864

6. Substitutions must be approved by Engineer during Bid Phase.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.

9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

12. Hydronic systems are flushed, filled, and vented.

13. Pumps are rotating correctly.

14. Proper strainer baskets are clean and in place.

15. Service and balance valves are open.

B. Beginning of work means acceptance of existing conditions.

3.3 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust air flow switches for proper operation.

O. For fans with variable pitch sheaves: Sheaves in equipment provided by manufacturer are for final belt and sheave sizing ONLY. TAB contractor shall be responsible for providing and installing final sheave and belt for fan.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCOPE

A. Test, adjust, and balance the following:

1. Plumbing Pumps.

2. HVAC Pumps.

3. Packaged Roof Top Heating/Cooling Units.

4. Water-source Heat Pumps

5. Vertical Unit Ventilators

6. Packaged Terminal Air Conditioning Units.

7. Fans.

8. Air Inlets and Outlets.

9. Kitchen exhaust fans and make-up air units, regardless of who provides or installs.

10. Airflow measuring stations.

3.8 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.

2. Model/Frame.

3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.

5. RPM.

6. Service factor.

7. Starter size, rating, heater elements.

8. Sheave Make/Size/Bore.

B. Pumps:

1. Identification/number.

2. Manufacturer.

3. Size/model.

4. Impeller.

5. Service.

6. Design flow rate, pressure drop, BHP.

7. Actual flow rate, pressure drop, BHP.

8. Discharge pressure.

9. Suction pressure.

10. Total operating head pressure.

11. Shut off, discharge and suction pressures.

12. Shut off, total head pressure.

C. Combustion Equipment:

1. Boiler manufacturer.

2. Model number.

3. Serial number.

4. Firing rate.

5. Burner manifold gas pressure.

6. Ambient temperature.

7. Heat output.

D. Heat Pump Coils:

1. Identification/number.

2. Location.

3. Service.

4. Manufacturer.

5. Air flow, design and actual.

6. Entering air DB temperature, design and actual.

7. Entering air WB temperature, design and actual.

8. Leaving air DB temperature, design and actual.

9. Leaving air WB temperature, design and actual.

10. Water flow, design and actual.

11. Water pressure drop, design and actual.

12. Entering water temperature, design and actual.

13. Leaving water temperature, design and actual.

14. Saturated suction temperature, design and actual.

15. Air pressure drop, design and actual.

E. Electric Duct Heaters:

1. Manufacturer.

2. Identification/number.

3. Location.

4. Model number.

5. Design kW.

6. Number of stages.

7. Phase, voltage, amperage.

8. Test voltage (each phase).

9. Test amperage (each phase).

10. Air flow, specified and actual.

11. Temperature rise, specified and actual.

F. Air Moving Equipment:

1. Location.

2. Manufacturer.

3. Model number.

4. Serial number.

5. Arrangement/Class/Discharge.

6. Air flow, specified and actual.

7. Return air flow, specified and actual.

8. Outside air flow, specified and actual.

9. Total static pressure (total external), specified and actual.

10. Inlet pressure.

11. Discharge pressure.

12. Sheave Make/Size/Bore.

13. Number of Belts/Make/Size.

14. Fan RPM.

G. Exhaust Fans:

1. Location.

2. Manufacturer.

3. Model number.

4. Serial number.

5. Air flow, specified and actual.

6. Total static pressure (total external), specified and actual.

7. Inlet pressure.

8. Discharge pressure.

9. Sheave Make/Size/Bore.

10. Number of Belts/Make/Size.

11. Fan RPM.

H. Duct Traverses:

1. System zone/branch.

2. Duct size.

3. Area.

4. Design velocity.

5. Design air flow.

6. Test velocity.

7. Test air flow.

8. Duct static pressure.

9. Air temperature.

I. Flow Measuring Stations:

1. Identification/number.

2. Location.

3. Size.

4. Manufacturer.

5. Model number.

6. Serial number.

7. Design Flow rate.

8. Design pressure drop.

9. Actual/final pressure drop.

10. Actual/final flow rate.

11. Station calibrated setting.

J. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

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SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.2 RELATED REQUIREMENTS

A. Section 23 0005 - Basic HVAC Requirements.

B. Section 233100 - HVAC Ducts and Casings: Glass fiber ducts.

1.3 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data, description, thermal and/or acoustical characteristics, list of materials and thickness for each service, and locations for duct insulation and duct liners to be used on project.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Johns Manville: www.jm.com/#sle.

3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Johns Manville: www.jm.com/#sle.

3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum Service Temperature: 450 degrees F.

3. Maximum Water Vapor Absorption: 5.0 percent.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

3. Secure with two coats of vapor barrier mastic and glass tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.

2. Armacell LLC: www.armacell.us/#sle.

3. K-Flex USA LLC: www.kflexusa.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

1. Minimum Service Temperature: Minus 40 degrees F.

2. Maximum Service Temperature: 180 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.5 DUCT LINER

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Johns Manville: www.jm.com/#sle.

3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.

C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

1. Minimum Service Temperature: Minus 40 degrees F.

2. Maximum Service Temperature: 180 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

D. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer.

1. Fungal Resistance: No growth when tested according to ASTM G21.

2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.

3. Service Temperature: Up to 250 degrees F.

4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

5. Minimum Noise Reduction Coefficients:

a. 1 inch Thickness: 0.45.

E. Adhesive: Waterproof, fire-retardant type, ASTM C916.

F. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

E. Slope exterior ductwork to shed water.

F. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 90 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.

3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Exhaust and Relief Ducts Within 10 ft of Exterior Openings:

1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

B. Outside Air Intake Ducts:

1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

C. Plenums:

1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

D. Return Air Ducts:

1. Duct Liner: 1 inch thick. First 10 feet from equipment only.

E. Supply Ducts:

1. Duct Liner: 1 inch thick. First 10 feet from equipment only.

2. Located in plenum or unconditioned space:

a. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

3. Located exposed in conditioned space:

a. No insulation required.

F. Tranfer Ducts:

1. Duct Liner: 1 inch thick. First 10 feet from equipment only.

G. Ducts Exposed to Outdoors:

1. Flexible Elastomeric Duct Insulation: 2 inches thick

2. Cover finished insulation with field applied a glass cloth jacket embedded in Foster No. 60-90 fire resistive mastic or a self-adhesive bitumen weather and vapor barrier (similar to Flexclad or Alumaguard).

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 232300 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Johns Manville Corporation: www.jm.com/#sle.

3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.

2. Maximum Service Temperature: 850 degrees F.

3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.

2. Armacell LLC: www.armacell.us/#sle.

3. K-Flex USA LLC: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.

2. Maximum Service Temperature: 180 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

2.4 JACKETS

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.

b. Maximum Service Temperature: 150 degrees F.

c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 10 mil.

e. Connections: Brush on welding adhesive.

2. Covering Adhesive Mastic: Compatible with insulation.

B. Painted Aluminum Jacket: ASTM C1729, Class A formed aluminum sheet.

1. Thickness: 0.020 inch (minimum) sheet.

2. Finish: Smooth. Painted White. Emittance value of at least 0.80.

3. Joining: Longitudinal joints shall be positioned at the 3 o'clock position and jacketing secured with 1/2" x .020" 300 series stainless steel banding and seals. Banding will be installed on 12" centers.

4. Fittings: 0.024 inch thick fitting covers with polyfilm moisture barrier.

5. A vapor retarder jacket that has no paper to absorb and retain moisture shall be used on insulation below aluminum jacketing.

6. A polyfilm moisture retarder, minimum 3 mil thickness, shall be used; polykraft is not allowed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

F. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

3. Do not bury hangers in the insulation. Insulation vapor barrier shall not be broken.

G. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

I. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

J. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

L. Exterior Applications:

1. Jacketing shall be smooth (not stucco embossed) white painted aluminum with polyfilm moisture retarder and shall be applied over dry substrate (vapor retarder jacket) and insulation with a minimum 2" overlap on both circumferential and longitudinal joints.

2. Jacketing shall be installed in a manner to shed water and in accordance with the Midwest Insulation Contractor Association's (M.I.C.A.) National Commercial and Industrial Standards which has been endorsed by the National Insulation Association (N.I.A.).

3. Insulate fittings, joints, and valves with insulation and jacketing of like material and thickness as adjoining pipe.

4. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

5. Jacketing shall be installed according to all manufacturer recommendations.

3.3 SCHEDULE

A. Cooling Systems:

1. Cold Condensate Drains: 1 inch thick.

2. Refrigerant Suction: 3/4 inch thick Flexible Elastomeric

3. Refrigerant Hot Gas: 3/4 inch thick Flexible Elastomeric

B. Other Systems:

1. Geothermal Heat Pump Loop Supply and Return: 1 inch thick.

SECTION 230800
MECHANICAL COMMISSIONING REQUIREMENTS KR

PART 1 GENERAL

1.1 SUMMARY

A. This specification includes the commissioning process requirements for mechanical equipment, systems and assemblies.

B. Refer to Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.2 SCOPE OF COMMISSIONING

A. The following mechanical equipment and systems are to be commissioned:

1. Roof Top Units
2. Dedicated Outdoor Air Units
3. Makeup Air Units
4. Split AC Systems
5. Exhaust Fans (25% qty)
6. Pumps
7. Radiant Ceiling Panels (25% qty)
8. Domestic Water Heaters
9. Electric Cabinet Unit Heaters (25% qty)
10. Electric Radiant Ceiling Panels (25% qty)
11. Air Cooled Condensing Units (25% qty)
12. Control Valves, F&Ts, and Thermostat Replacements (25% qty)
13. Water Source Heat Pumps
14. Vertical Unit Ventilators

B. Refer to Division 01 Section "General Commissioning Requirements" for general commissioning scope.

1.3 DEFINITIONS

A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.4 DOCUMENTATION

A. Refer to Division 01 Section "General Commissioning Requirements" for documentation to be provided by the CxA.

B. Refer to Division 01 Section "General Commissioning Requirements" for documentation to be provided by the construction manager and contractor. In addition, provide the following:

1. Equipment Start Up Reports. See equipment specific specifications for Start Up requirements.

1.5 COORDINATION

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to coordination during the commissioning process.

1.6 RESPONSIBILITIES

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to responsibilities during the commissioning process.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.

B. Special equipment, tools and instruments (specific to a piece of equipment and only available from the vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.

C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.

D. Temporary data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5F and a resolution of + or - 0.1F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 EXECUTION

3.1 STARTUP PLANS AND REPORTS

A. For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 2 weeks prior to startup.

B. For each item of equipment and system for which the manufacturer provides a startup report, document compliance by submitting the completed startup checklist and final startup report, signed and dated by the responsible entity.

3.2 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or system to be commissioned.

1. These checklists do not replace manufacturer's recommended startup checklists regardless of apparent redundancy.

2. The following types of information will be gathered via the completed Prefunctional Checklist forms:

a. Certification by installing contractor that the unit is properly installed, started up, operating, and ready for Functional Testing.

b. Manufacturer, model number, and relevant capacity information. List information "as installed."

c. Serial number of installed unit.

B. Contractor is responsible for filling out Prefunctional Checklists after completion of installation and before operational startup. Witness of operational startup by the Commissioning Authority is not required unless otherwise specified.

1. Each line item is to be initialed and dated by the Contractor. Checklists are not complete until all line items are initialed and dated without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing. Re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer. Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Contractor may independently perform startup inspections and/or tests at Contractor's option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.

1. Provide all additional information requested by Commissioning Authority to aid in preparation of Checklists, such as shop drawing submittals, manufacturer’s startup checklists, and operation & maintenance data.

2. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.

D. Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.3 EQUIPMENT AND SYSTEM STATIC TESTING PROCEDURS

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23 sections. Provide submittals, test data, inspector record, and certifications to the CxA.

B. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 23 piping Sections. Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.

2. Description of equipment for flushing operations.

3. Minimum flushing water velocity.

4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

C. Pipe and Ductwork Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

D. CxA shall witness all or part of any ductwork leakage testing and pipe pressure testing procedures, sufficient to be confident that proper procedures were followed. Notify Owner's project manager of any deficiencies in results or procedures.

3.4 TESTING ADJUSTING AND BALANCING VERIFICATION

A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

D. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.

E. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

F. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

G. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.5 FUNCTIONAL TESTS

A. A Functional Test is required for EACH item of equipment, system, or other assembly specified to be commissioned unless SAMPLING of multiple identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests after completion of Prefunctional Checklists and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner. If a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and record the Contractor's stated intentions for correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment, or system that is not in compliance with Contract Documents or does not perform properly.

2. When the deficiency has been corrected, the Commissioning Authority will reschedule the test and the Contractor shall re-test.

3. If 10 percent of identical items fail to perform due to materials or manufacturing defect, all items will be considered defective. Contractor shall provide a proposal for correction within 2 weeks after notification of defect.

4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time to witness re-testing.

E. Functional Test Procedures:

1. Examples of Functional Testing:

a. Test the dynamic function of equipment and systems using direct observation and/or monitoring methods under full operation.

b. Systems are tested under various conditions such as high heating/cooling loads, low heating/cooling loads, component failures, unoccupied mode, fire alarm, power failure, etc.

c. Systems are subjected to all controls and building automation system sequences of operation. Components are verified to respond accordingly.

F. Deferred Functional Tests: Some tests may need to be performed after substantial completion due to partial occupancy, seasonal requirements, or other site conditions. Performance of these tests remains the Contractor's responsibility regardless of timing.

3.6 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon dioxide, pressure sensors, gauges, and actuators. Unit factory-installed sensors with calibration certification do not require field calibration.

B. Calibrate using the methods described below. Alternate methods may be used, if approved by Commissioning Authority and Owner beforehand.

C. Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. Conduct reading with calibrated test instrument within 6 inches of the site sensor.

4. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances of table below.

D. Sensor Tolerances

1. Watthour, Voltage, Amperage: 1 percent of design.

2. Pressure: 3 percent of design.

3. Temperature: 0.4 degrees F of design.

4. Relative Humidity: 4 percent of design.

5. Barometric Pressure: 0.1 inch Hg of design.

6. Flow Rate, air: 10 percent of design.

7. Flow Rate, water: 4 percent of design.

8. Flow Rate, steam: 3 percent of design.

9. Wet Bulb and Dew Point: 2.0 degrees F of design.

10. Water Temperature: 0.4 degrees F of design.

11. Oxygen and CO2 Monitors: 0.1 percent of design.

E. Valve/Damper Stroke Setup and Checkout

1. For all valve/damper actuator positions, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed, visually verify that valve/damper is closed, and adjust output zero signal as required.

4. Command valve/damper to open, verify position is full open, and adjust output signal as required.

5. Command valve/damper to a multiple intermediate positions.

3.7 TEST PROCEDURES – GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test conditions.

C. C. Identical Units

1. Identical units are defined as those with the same application and sequence of operation except for minor size or capacity differences.

2. 2. Where sample Functional Testing of identical units is permitted, test 30% of the project total. If half of these units fail Functional Testing, all units (i.e. 100% of the project total) shall be inspected and issues remediated by the Contractor. Thereafter, all units (i.e. 100% of the project total) shall undergo Functional Testing.

3. Sampling is not allowed for:

a. Major equipment.

b. Life-safety-critical equipment.

D. For Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance.

E. For Simulated Conditions: Artificially create the necessary condition for the purpose of testing the response of a system.

F. For Over-Writing Values: Change the sensor value known to the control system to see the response of the system.

G. For Indirect Indicators: Observe a response or condition indirectly from a control system screen or other device.

H. For Monitoring: Record parameters of equipment operation using trending capabilities of the control system. Where monitoring of specific points is called for in Functional Testing, complete the following:

1. Provide hard copies of monitored data in columnar format.

2. Alternately, provide graphical output if producible by the system.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Contractor provide final operation & maintenance manuals of commissioned equipment to the Commissioning Authority for review. Contractor to make changes recommended by the Commissioning Authority.

3.9 DEMONSTRATION AND TRAINING

A. Contractor submit training plan for Owner personnel to the Commissioning Authority for review and approval.

B. Contractor coordinate scheduling of specified training sessions with invitations to the Commissioning Authority.

C. Contractor provide sign-in sheet and agenda for each training session along with copies of training aids and documentation to the Commissioning Authority for review.

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SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control panels.

B. Control Valves:

1. Ball valves and actuators.

2. Butterfly pattern.

3. Electronic operators.

C. Dampers.

D. Damper Operators:

1. Electric operators.

E. Input/Output Sensors:

1. Temperature sensors.

2. Humidity sensors.

3. Static pressure (air pressure) sensors.

4. Equipment operation (current) sensors.

5. Carbon monoxide sensors.

6. Carbon dioxide sensors.

F. Thermostats:

1. Low-limit temperature cutout switch (freezestat)

2. Line voltage thermostats.

3. Room thermostat accessories.

4. Outdoor reset thermostats.

5. Airstream thermostats.

6. Electric low limit duct thermostats.

7. Electric high limit duct thermostats.

G. Transmitters:

1. Pressure transmitters.

2. Air pressure transmitters.

3. Water pressure transmitters (liquid differential pressure transmitters).

4. Temperature transmitters.

5. Humidity transmitters.

H. Energy Metering:

1. Hydronic BTU (J) meters.

I. Flow Sensors:

1. Airflow measurement station (AFMS).

2. Insertion electromagnetic flow meters.

1.2 RELATED REQUIREMENTS

A. Section 230519 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.

B. Section 230923 - Direct-Digital Control System for HVAC.

C. Section 232113 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.

D. Section 232114 - Hydronic Specialties.

E. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

F. Section 262726 - Wiring Devices: Elevation of exposed components.

1.3 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Manufacturer's Instructions: Provide for all manufactured components.

E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

F. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.3 CONTROL VALVES

A. Performance Requirements:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

3. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements" to size products where indicated as delegated design.

4. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

5. Backup Power Source: Systems and equipment served by a backup power source shall have associated control valve actuators served from a backup power source.

6. Environmental Conditions:

   a. Provide electric control valve actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control valve actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

7. Determine control valve sizes and flow coefficients by ISA 75.01.01.

8. Control valve characteristics and rangeability shall comply with ISA 75.11.01.

9. Selection Criteria:

   a. Control valves shall be suitable for operation at following conditions:

      1) Chilled Water: 150 PSI.

      2) Condenser Water: 150 PSI.

      3) Heating Hot Water: 150 PSI.

   b. Control valve shutoff classifications shall be FCI 70-2, Class IV or better unless otherwise indicated.

   c. Valve pattern, three-way or straight through, shall be as indicated on Drawings.

   d. Modulating straight-through pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.

   e. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.

   f. Modulating butterfly valves shall have linear or equal percentage flow-throttling characteristics.

   g. Fail positions unless otherwise indicated:

1) Chilled Water: Open.

2) Condenser Water: Open.

3) Heating Hot Water: Open.

h. Globe-type control valves shall pass the design flow required with not more than 95 percent of stem lift unless otherwise indicated.

i. Rotary-type control valves, such as ball and butterfly valves, shall have Cv falling between 65 and 75 degrees of valve full open position and minimum valve Cv between 15 and 25 percent of open position.

j. Selection shall consider viscosity, flashing, and cavitation corrections.

k. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.

l. In water systems, select modulating control valves for a design Cv based on a pressure drop of twice the device it is controlling with a minimum of 2.3 ft and maximum of 10 ft, unless otherwise reviewed by Engineer.

m. Two-position control valves shall be line size unless otherwise indicated.

n. In water systems, use ball- or globe-style control valves for two-position control for valves NPS 2 and smaller and butterfly style for valves larger than NPS 2.

B. Ball Valves and Actuators:

1. Manufacturers:

a. Belimo Aircontrols (USA), Inc: www.belimo.com/#sle.

b. Flow Tech.

c. Substitutions: See Section 016000 - Product Requirements.

2. Service: Use for brine (30 percent glycol), chilled water, or hot water.

3. Flow Characteristic: Equal percentage. Include 2-way and 3-way mixing operation configured to fail normally open (NO). Refer to Drawings.

4. Replacements in Kind: Provide pressure-independent type.

5. Rangeability: 500 to 1.

6. ANSI Rating: Class 300.

7. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.

8. Body Size:

a. Under 2-1/2 inches:

1) Connection: NPT.

2) Materials:

(a) Body: Brass.

(b) Flanges: Ductile iron.

(c) Ball: Chrome-plated brass.

(d) Stem: Nickel-plated brass.

(e) Stem sleeve or other approved means to allow valve to be opened and closed without damaging field-applied insulation and insulation vapor barrier seal.

(f) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

(g) Stem Seal: EPDM O-Rings.

(h) Flow Control Disk: Thermoplastic synthetic-resin.

b. Service Temperature:

1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.

2) Ambient Side: From minus 4 to 122 degrees F.

9. Actuator Requirements:

a. Assembly: Factory-mounted.

b. Input: 0 to 5 VDC configured for proportional control.

c. Accessories: Provide with valve position indicator and manual override.

C. Butterfly Pattern:

1. Manufacturers:

a. Flow Tech.

b. Belimo Aircontrols (USA), Inc..

c. Substitutions: See Section 016000 - Product Requirements.

2. Iron body, stainless steel disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.

3. Hydronic Systems:

a. Rate for service pressure of 125 psig at 250 degrees F.

D. Electronic Operators:

1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.

2. Select operator for full shut off at maximum pump differential pressure.

3. Position indicator and graduated scale on each actuator.

4. Type: Motor operated, with or without gears, electric and electronic.

5. Voltage: Voltage selection delegated to professional designing control system.

6. Deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.

7. Function properly within a range of 85 to 120 percent of nameplate voltage.

8. Construction:

a. For Actuators Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.

b. For Actuators from 100 to 400 W: Gears ground steel, oil immersed, shaft hardened steel running in bronze, copper alloy or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel or cast-aluminum housing.

c. For Actuators Larger Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

9. Field Adjustment:

a. Spring Return Actuators: Easily switchable from fail open to fail closed in the field without replacement.

b. Gear Type Actuators: External manual adjustment mechanism to allow manual positioning when the actuator is not powered.

10. Two-Position Actuators: Single direction, spring return or reversing type.

11. Modulating Actuators:

a. Operation: Capable of stopping at all points across full range, and starting in either direction from any point in range.

b. Control Input Signal:

1) Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs.

2) One input drives actuator to open position and other input drives actuator to close position. No signal of either input remains in last position.

3) Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for zero- to 10 and 4- to 20-mA signals.

4) Pulse Width Modulation (PWM): Actuator drives to a specified position according to pulse duration (length) of signal from a dry contact closure, triac sink, or source controller.

5) Programmable Multi-Function:

6) Control Input, Position Feedback, and Running Time: Factory or field programmable.

7) Diagnostic: Feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.

8) Service Data: Include, at a minimum, number of hours powered and number of hours in motion.

12. Position Feedback:

a. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.

b. Equip modulating actuators with a position feedback through voltage signal for remote monitoring.

c. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

13. Fail-Safe:

a. Where indicated, provide actuator to fail to an end position.

b. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.

c. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

14. Integral Overload Protection:

a. Provide against overload throughout the entire operating range in both directions.

b. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

15. Valve Attachment:

a. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to valve shaft without the need for connecting linkages.

b. Attach actuator to valve drive shaft in a way that ensures maximum transfer of power and torque without slippage.

c. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

16. Temperature and Humidity:

a. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.

b. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

17. Enclosure:

a. Suitable for ambient conditions encountered by application.

b. NEMA 250, Type 2 for indoor and protected applications.

c. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.

d. Provide actuator enclosure with heater and control where required by application.

18. Stroke Time:

a. Operate valve from fully closed to fully open within 60 seconds.

b. Operate valve from fully open to fully closed within 60 seconds.

c. Move valve to failed position within 15 seconds.

d. Select operating speed to be compatible with equipment and system operation.

19. Sound:

a. Spring Return: 62 dBA.

b. Non-Spring Return: 45 dBA.

2.4 CONTROL DAMPERS

A. Performance Requirements:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

3. Delegated Design: Engage a qualified professional, as defined in Section 014000 "Quality Requirements," to size products where indicated as delegated design.

4. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

5. Backup Power Source: Systems and equipment served by a backup power source shall have associated control damper actuators served from a backup power source.

6. Environmental Conditions:

7. Provide electric control-damper actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated.

8. Electric control-damper actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

9. Hazardous Locations: Explosion-proof rating for condition.

10. Selection Criteria:

    a. Fail positions unless otherwise indicated:

        1) Supply Air: Last position.

        2) Return Air: Last position.

        3) Outdoor Air: Last position.

        4) Mixed Air: Last position.

        5) Exhaust Air: Last position.

    b. Dampers shall have stable operation throughout full range of operation, from design to minimum airflow over varying pressures and temperatures encountered.

    c. Select modulating dampers for a pressure drop of 2 percent of fan total static pressure unless otherwise indicated.

    d. Two-position dampers shall be full size of duct or equipment connection unless otherwise indicated.

e. Pneumatic, two-position control dampers shall provide a smooth opening and closing characteristic slow enough to avoid excessive pressure. Dampers with pneumatic actuators shall have an adjustable opening time (valve full closed to full open) and an adjustable closing time (valve full open to full closed) ranging from zero to 10 seconds. Opening and closing times shall be independently adjustable.

f. Control-damper, pneumatic-control signal shall not exceed 200 feet. For longer distances, provide an electric/electronic control signal to the damper and an electric solenoid valve or electro-pneumatic transducer at the damper to convert the control signal to pneumatic.

11. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.

12. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.

13. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

B. Manufacturers:

1. Ruskin.

2. Greenheck.

3. Tamco.

4. Substitutions: See Section 016000 - Product Requirements.

C. Performance: Test in accordance with AMCA 500-D.

D. Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.

E. Blade Seals: Synthetic elastomeric, mechanically attached, field replaceable.

F. Jamb Seals: Spring stainless steel.

G. Shaft Bearings: Molded synthetic or stainless-steel sleeve mounted in frame..

H. Leakage: Less than one percent based on approach velocity of 2000 ft per min and 4 inches wg.

I. Pressure Drop: 0.05-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.

J. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

2.5 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.

2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:

1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.6 INPUT/OUTPUT SENSORS

A. Temperature Sensors:

1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.

2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.

3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.

4. Temperature Sensing Device: Compatible with project DDC controllers.

5. Performance Characteristics:

a. RTD:

1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.

2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.

3) All Other Accuracy: Plus/minus 0.75 degrees F minimum.

b. Thermistor:

1) Accuracy (All): Plus/minus 0.36 degrees F minimum.

2) Range: Minus 25 degrees F through 122 degrees F minimum.

c. Sensing Range:

1) Provide limited range sensors if required to sense the range expected for a respective point.

2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.

3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.

d. Wire Resistance:

1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.

2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.

e. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.

f. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.

g. Immersion Temperature Sensors for Geothermal: Temperature sensors indicated shall be immersion well type with adjustable temperature differential.

h. Ceiling and Recessed Mount Temperature Sensors: Ceiling-mounted sensor in a low-profile housing.

i. Room Temperature Sensors:

1) Construct for surface or wall box mounting.

2) Provide the following:

(a) Setpoint reset slide switch with an adjustable temperature range.

(b) Individual heating/cooling setpoint slide switches.

(c) Momentary override request push button for activation of after-hours operation.

j. Room Temperature Sensors with Integral Digital Display:

1) Construct for surface or wall box.

2) Provide a four button keypad with the following capabilities:

(a) Indication of space and outdoor temperatures.

(b) Setpoint adjustment to accommodate room setpoint and Sequence of Operation.

(c) Display and control fan operation status.

(d) Manual occupancy override and indication of occupancy status.

(e) Controller mode status.

(f) Password enabled setpoint and override modes.

B. Humidity Sensors:

1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.

a. Humidity:

1) HS Element: Digitally profiled thin-film capacitive.

2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.

(a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).

3) Scaling: 0 to 100 percent RH.

b. Temperature Effect:

1) Duct Mounted: Plus/minus 0.18 percent per degree F.

2) Outdoor Mounted: 4 to 20mA version: (0.0013x%RHx(TdegreeC-25)).

c. Hysteresis: 1.5 percent typical.

d. Linearity: Included in accuracy specification.

e. Reset Rate: 24 hours.

f. Stability: Plus/minus 1 percent at 68 degrees F (20 degrees C) annually, for two years.

C. Static Pressure (Air Pressure) Sensors:

1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.

2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.

3. Accuracy: One percent of full scale with repeatability 0.3 percent.

4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation (Current) Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.

2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.

3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Carbon Monoxide Sensors, for Single-Gang Electrical Box Mounting:

1. General:

a. Provide gas platform, wired to the building controller, with replaceable sensor.

b. Input Power: Class 2; 15 to 30 VDC/24 VAC plus/minus 20 percent, 50/60 Hz.

F. Carbon Dioxide Sensors, Duct and Wall:

1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.

2.7 THERMOSTATS

A. Low-Limit Temperature Cutout Switch (low-limit thermostat or freezestat):

1. Configuration: Digital module tied to sensor-assembly.

2. Sensing Length: 4 feet.

3. Setpoint Adjust: Slider.

4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.

5. Mounting: Locate on cooling coil intake side.

6. Field Interface: Connect load line-voltage to stater.

7. Electrical Rating: Pilot duty, 125 VA at 125 to 600 VAC.

B. Room Thermostat Accessories:

1. Thermostat Covers: Vandal proof clear plastic..

2. Insulating Bases: For thermostats located on exterior walls.

C. Outdoor Reset Thermostats:

1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.

2. Scale range: Minus 10 to 70 degrees F.

D. Airstream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.

2. Averaging service remote bulb element: 7.5 feet.

E. Electric Low Limit Duct Thermostats:

1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,

2. Bulb length: Minimum 20 feet.

3. Provide one thermostat for every 20 sq ft of coil surface.

F. Electric High Limit Duct Thermostats:

1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,

2. Bulb length: Minimum 20 feet.

3. Provide one thermostat for every 20 sq ft of coil surface.

2.8 TRANSMITTERS

A. Pressure Transmitters:

1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

B. Air Pressure Transmitters:

1. General: Provide dry media differential pressure transducers to monitor duct and room pressure.

a. Response Time:

1) Fast: T95 in 2 seconds.

2) Switch selectable.

b. Mode: Switch selectable, unidirectional.

C. Water Pressure Transmitters (Liquid Differential Pressure Transmitters):

1. Manufacturers:

a. Veris Industries: www.veris.com/#sle.

b. Substitutions: See Section 016000 - Product Requirements.

2. General: Provide wet media differential pressure transducers with 10 ft (3.5 m) shieldedcable, to allow remote pressure sensing capability.

a. Input Power: Class 2; 15 to 30 VDC, 24VAC nominal, 50/60 Hz.

b. Output: 3-wire transmitter; user-selectable, 4 to 20 mA (0 to 5V/0 to 10V).

c. Sensor:

1) Media Compatibility: 17 to 4 PH stainless steel.

2) Status Indication: Dual color LED.

3) Proof Pressure: 2x max. F.S. range.

4) Burst Pressure: 5x max. F.S. range.

d. Operating Conditions:

1) Temperature Compensated Range:

(a) TC Zero less than 1.5 percent of product F.S. (full scale) per sensor.

D. Temperature Transmitters:

1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 50 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

E. Humidity Transmitters:

1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.9 ENERGY METERING

A. Hydronic BTU (J) Meters:

1. Manufacturers:

a. Onicon.

2. Provide BTU (J) meter with wall mount hardware capable of being installed remotely from the flow meter.

3. Include LCD display for local indication of energy rate including settings and parameters during configuration.

4. Factory configure to the specific application with field configuration by the user via the front panel keypad without the requirement of a computer or special interface.

5. Output to indicate energy rate, energy total, flow rate, and supply/return temperature.

6. Integral transmitter to provide a linear analog or configurable pulse output signal representing the energy rate with the signal compatible with the building automation system DDC hardware to which the output is connected.

7. Insertion Electromagnetic Type

   a. Materials of construction for wetted metal components shall be 316 SS. For installations in non-metallic pipe, install grounding rings or probes. The flow meter shall average velocity readings from two sets of diametrically opposed electrodes. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST*. A certificate of calibration shall be provided with each flow meter. Accuracy shall be within ± 1% of rate from 2-20 ft/s. Overall turndown shall exceed 100:1. Output signals shall be completely isolated and shall consist of the following: (1) high resolution frequency output for use with peripheral devices such as an ONICON display module or Btu meter, (1) analog output; 4-20mA, 0-10V, or 0-5V jumper selectable and (1) scalable dry contact output for totalization.

2.10 FLOW SENSORS

A. Airflow Measurement Station (AFMS):

1. Manufacturers:

   a. EBTRON, Inc. located at 1663 Hwy. 701 S, Loris, SC 29569, USA. Phone 1-888-445-HVAC (4822) Web: www.bluefieldes.com. Sales e-mail: sales@bluefieldes.com.

   b. Substitutions: See Section 016000 - Product Requirements.

2. Description:

   a. Provide thermal airflow measurement station (AFMS) for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans or schedules.

   b. Each AFMS shall use the principal of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.

c. Each AFMS shall be provided with one or more sensor probes having one or more sensor nodes per probe.

d. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs or similar “hot wire” devices are not acceptable.

e. Thermistors shall be potted in an engineering thermoplastic assembly using water-proof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.

f. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.

g. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.

h. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.

i. Each sensor node shall be independently processed by the transmitter prior to averaging and output.

j. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.

k. Installed accuracy shall include the uncertainty of the AFMS and the additional uncertainty that results from the placement of the AFMS in the airstream. The specified installed accuracy is based on the AFMS being installed in accordance with manufacturers published placement and installation guidelines.

l. Transmitters shall be microprocessor-based and operate automatically after brownouts and/or transient power interruptions.

m. All printed circuit boards shall have gold plated interconnects, edge fingers, and test points.

n. Remote transmitters shall have an LCD and four-button user interface.

o. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120 °F [-28.9 to 48.9 °C] and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.

p. Probes with remote transmitters shall be “plug and play”, not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.

q. All components of each AFMS shall be RoHS2 compliant.

r. Each AFMS shall be UL/cUL listed as a final assembly.

s. Each AFMS shall be FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.

t. Devices with a BACnet network connection shall be BTL tested and listed.

3. Duct And Plenum AFMS With Temperature Measurement and Remote Transmitter

a. Each AFMS shall be suitable for installation in ducts and plenums; including air handling equipment cabinets and outdoor air intakes to determine the airflow rate and velocity-weighted temperature of the airstream.

b. Provide one to four gold anodized 6063 aluminum probes and one remote transmitter.

c. Probes shall have integral 304 stainless steel mounting brackets for insertion, internal or standoff mounting.

d. Probe connector plug and receptacle pins shall be gold plated.

e. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of ±2% of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.

f. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of ±3% of reading (±5% of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm [0 to 25.4 m/s] over a temperature range of -20 to 160 °F [-28.9 to 71.1 ºC].

g. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15 °F [0.08 °C].

h. This product shall be used for temperature measurement when the required measurement location for temperature is satisfied by the measurement location of the AFMS.

i. Provide low and high airflow alarms with a user defined setpoint and tolerance.

j. The airflow rate, temperature, airflow alarm and system status alarm shall be visible on the transmitters display.

k. Transmitters with analog output signals shall provide:

1) One linear output signal for airflow.

2) One linear output signal for velocity-weighted temperature or one binary signal for the airflow alarm or system status alarm.

l. Transmitters with network capability shall provide the airflow, velocity-weighted temperature, airflow alarm status, individual sensor node airflow and temperature data and device fault status.

m. Transmitters shall be provided with a 16-character by two-line, backlit, alpha-numeric LCD.

n. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow, temperature monitoring, and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature/humidity data, transmitter settings and diagnostics information. This shall be available for and utilized by commissioning agent, balancer, controls contractor, and owner.

o. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 22 V-A.

4. Fan Airflow and Temperature Measurement with Remote Transmitter

a. Each AFMS shall be suitable for installation in fan inlets to determine the airflow rate and velocity weighted temperature of the airstream.

b. Provide throat, face, forward or flare mount adjustable brackets for each sensor node.

c. Each mounting bracket shall have integral 304 stainless steel mounting feet for mounting in or on the fan inlet.

d. The AFMS shall not affect the airflow or sound performance of plenum fans.

e. All sensors shall be connected to a single, remote transmitter. Fan array models shall calculate the airflow of each fan individually prior to outputting the total airflow rate and have a built-in alarm capable of removing a failed fan from the total airflow calculation.

f. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of ±2% of reading over the entire operating range of 0 and 10,000 fpm [50.8 m/s] over a temperature range of -20 to 160 °F [-28.9 to 71.1 ºC] and a humidity range between 0 and 100% RH (non-condensing).

g. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15 °F [0.08 °C].

h. This product shall be used to for temperature measurement when the required measurement location for temperature is satisfied by the measurement location of the AMD.

i. Provide low and high airflow alarms with a user defined setpoint and tolerance.

j. Provide a fan fault alarm when installed on fan arrays.

k. The airflow rate, temperature, airflow alarm, fan fault alarm and system status alarm shall be visible on the transmitters display.

l. Transmitters with analog output signals shall provide:

1) One linear output signal for airflow.

2) One linear output signal for velocity weighted temperature or one binary signal for the airflow alarm or system status alarm, or one multi-state signal for the fan array fault alarm (/An models only).

m. Transmitters with network capability shall provide the airflow, velocity-weighted temperature, airflow alarm status, fan array fault alarm (/An models), individual sensor node airflow and temperature data and device fault status.

n. Transmitters shall be provided with a 16-character by two-line, backlit, alpha-numeric LCD.

o. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow, temperature monitoring, and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature/humidity data, transmitter settings and diagnostics information. This shall be available for and utilized by commissioning agent, balancer, controls contractor, and owner.

B. Electromagnetic Flow Meters:

1. Manufacturers:

a. ONICON, Incorporated..

b. Substitutions: See Section 016000 - Product Requirements.

2. Inline Flow Meter

   a. Provide an inline electromagnetic flowmeter complete with NIST traceable, wet calibrated flow-measuring element, transmitter, visual display, ANSI Class 150 or 300 mounting flanges, and calibration certificate.

   b. Accuracy: 0.02 percent of value applied to manufacturer-specified velocity range.

   c. Calibration: Each flowmeter shall receive a wet calibration, within the expected operating range, against a primary volumetric standard that is traceable to NIST.

   d. Construction: Stainless steel sensor with integral NEMA 250 Type 4 or 4X stainless steel or aluminum enclosure to hold thermal mass sensor and circuits with numeric display for demand, consumption, and other parameter readings.

   e. Input: 24 VAC/DC, 60 Hz, 12 VA

   f. Output: Two (2) digital outputs, one (1) digital input and one (1) analog output

   g. Service Pressure and Temperature: Up to 400 psi and 15 to 250 degrees F liquid side, 150 degrees F ambient.

   h. Options:

      1) Menu driven user interface via three (3) programming keys

      2) Flange grounding kit

3. Insertion Flow Meter - Option for Existing Systems or New Systems with Engineer Pre-Approval

   a. Provide an insertion electromagnetic flowmeter complete with NIST traceable, wet calibrated flow-measuring element, integral transmitter, installation valves, installation depth gage and calibration certificate. Flowmeter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.

   b. Accuracy: 1 percent of value applied to manufacturer-specified turndown.

   c. Calibration: Each flowmeter shall receive a wet calibration, within the expected operating range, against a primary volumetric standard that is traceable to NIST.

   d. Construction: Wetted components shall be constructed of 316L stainless steel with attached tag indicating calibration information.

   e. Input: 24 VAC/DC, 60 Hz

   f. Output: Two (2) digital outputs, one (1) digital input and one (1) analog output

   g. Service Pressure and Temperature: Up to 400 psi and 15 to 200 degrees F liquid side, 200 degrees F ambient.

h. Options:

1) Local display shall provide instantaneous flow rate information and totalized flow information and shall be factory configured for connection to a specific flowmeter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2 INSTALLATION

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Install in accordance with manufacturer's instructions.

D. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats.

E. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

F. Provide guards on thermostats in public areas and where indicated.

G. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

H. Provide isolation (two position) dampers of parallel blade construction.

I. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

J. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

K. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

L. Provide conduit and electrical wiring in accordance with Division 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

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SECTION 230915
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency drives. This specification is to cover a complete variable frequency motor drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 23 0005 - Basic HVAC Requirements.

D. Division 26 - Electrical

1.3 REFERENCE STANDARDS

A. NEMA ICS 7.1

B. NEMA ICS 7

C. IEEE 519

D. UL 508A

E. UL 508

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Manufacturer's Field Reports: Indicate start-up inspection findings.

E. Qualifications: VFDs and options shall be UL listed as a complete assembly. The base VFD shall be UL listed for 100 KAIC without the need for input fuses. It is required that the drive manufacturer has an existing sales representative exclusively for HVAC products with expertise in HVAC systems and controls, and an independent service organization.

1.5 WARRANTY

A. Warranty shall be twenty-four (24) months from the date of certified startup, not to exceed thirty (30) months from the date of manufacture. The warranty shall include all parts, labor, travel time and expenses.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB U.S.; Model ACH 550: www.abb.us/drives.com.

B. Danfoss

C. Square D www.squared.com.

2.2 DESCRIPTION

A. Variable Frequency Drives: The VFD shall be solid state, with a pulse width modulated (PWM) output. The VFD package, as specified herein, shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier, integral line reactors, capacitors and insulated gate bipolar transistors as the output switching device. The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

2.3 OPERATING REQUIREMENTS

A. Rated Input Voltage: Input 460/480 VAC +/- 10 percent, 3-phase, 48-63 Hz or input 208/220/230/240 VAC +/- 10 percent 3-phase, 48-63 Hz Undervoltage trip at rated input -35 percent. Overvoltage trip at rated input +30 percent.

B. Interrupt Rating: 65 kAIC, suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amps, 480V maximum.

C. Output Frequency: 0 to 250 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.

D. Operating Conditions: 0 to 40C, less that 95 percent humidity, noncondensing.

E. VFD Enclosure: The VFD package, as specified herein, shall be enclosed in a UL listed Type 12 enclosure, completely assemble and tested by the manufacturer in an ISO9001 facility.

F. Input Signal: 4 to 20 mA DC.

2.4 COMPONENTS

A. Display: All VFDs shall have the same customer interface, including digital display and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters and for stepping through the displays and menus. The keypad shall be removable, be capable of remote mounting, and have its own nonvolatile memory. The keypad shall include hand-off-auto membrane selections. When in "Hand" the VFD will be started and the speed will be controlled from the up/down arrows. When in "Off" the VFD will be stopped. When in "Auto" the VFD will start via and external speed reference. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Auto" and "Hand" modes. There shall be fault reset and "Help" buttons on the keypad. The "Help" button shall include "on-line" assistance for programming and troubleshooting.

1. The VFDs shall utilize preprogrammed application macros specifically designed to facilitate startup. The application macros shall provide on command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow end-user to create and save custom settings.

2. There shall be a built in time clock in the VFD keypad. The clock shall have a battery backup with a ten (10) year minimum lifespan. The clock shall be used to date and time stamp faults and record operation parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power-up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock, when in the off mode, for a programmable timeframe. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

B. Status Indicators: The following operating information displays shall be standard on the VFD digital display, All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words, alpha-numeric codes are not acceptable.

1. Output Frequency.

2. Motor Speed (RPM, percent or engineering units).

3. Motor Current.

4. Calculated Motor Torque.

5. Calculated Motor Power (kW).

6. DC Bus Voltage.

7. Output Voltage.

8. Analog Input Values.

9. Analog Output Values.

10. Keypad Reference Values.

11. Elapsed Time Meter (resettable).

12. kWh meter (resettable).

13. Digital Input Status.

14. Digital Output Status.

15. Ammeter.

C. The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage or loss of input signal protective trip. The number of restart attempts, trial time and time between reset attempts shall be programmable.

1. The VFD shall be capable of starting into a rotating load and accelerate or decelerate to setpoint without safety tripping or component damage. The VFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.

2. The VFD shall be equipped with an automatic extended control power ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Typical control power ride-through for a fan load shall be two (2) seconds minimum.

3. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the use the option of either: stopping and displaying fault, running at a programmable preset speed, hold the VFD speed based on the last good reference received, or cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and or over the serial communication bus.

4. The customer terminal strip shall be isolated from the line and ground.

5. The drive shall be employ current limit circuits to provide trip free operation: The slow current regulation limit circuit shall be variable to 150 percent (minimum) of the VFD's normal duty current rating. This adjustment shall be made via the keypad and shall be displayed in actual amps, not as a percent of full load. The current switch-off limit shall be fixed at 350 percent (minimum, instantaneous) of the VFD's normal duty current rating.

6. The overload rating of the drive shall be 110 percent of its normal duty current rating for one minute in every ten minutes, 130 percent overload for two seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL Table 430-150 for 4-pole motors.

7. The VFD shall have an integral 5 percent impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule-rated MOV's (phase to phase and phase to ground), a capacitor clamp and 5 percent impedance reactors.

8. The VFD shall be capable of sensing a loss of load (broken belt, no water in pump, etc.) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and or over the serial communications bus.

D. VFD Adjustments: Three programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. Two PID setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. There shall be a independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process. All setpoints, process variables, etc, to be accessible from the serial communication network. Two programmable analog inputs shall accept a current or voltage signal for speed reference or for reference and actual signals for PID controller. Two programmable analog outputs (0-20 ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power, and other data. Six programmable digital inputs. Three programmable digital Form C relay outputs. Seven programmable preset speeds. Two independently adjustable accel and decal ramps.

E. Serial Communications: The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus and Johnson Controls NS bus, with optional protocols for LonWorks, BACnet and Ethernet available. Serial communications capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decal time adjustments, and lock/unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current, precent torque, kilowatt hours, operating hours and drive temperature. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface.

F. Microprocessor based Bypass Controller: A complete factory wired and tested bypass system consisting of an input contactor, output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes. Controller shall be manual or automatic (selectable) transfer to line power via contactors. A keypad to control the bypass controller shall be mounted on the enclosure door. The bypass keypad shall include a one-one diagram and status LED's to indicate the mode of operation, drive and bypass status, and ready and enable conditions. When in "Drive" mode, the bypass contactor is open and the drive output contactor is closed. In the "Bypass" position, the drive output contactor is open and the bypass controller is closed.

G. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

H. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

I. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

J. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Provide fuses in fusible switches; refer to Section 16491 for product requirements.

D. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

E. Power wiring shall be completed by the electrical contractor.

F. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide the service of the manufacturer's field representative to prepare and start controllers. Certified factory startup shall be provided for each drive by a factory-authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner and a copy kept on file at the manufacturer.

3.3 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

SECTION 230925
DIRECT-DIGITAL CONTROL (DDC) SYSTEMS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control Equipment

B. Software

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions.

C. Section 23 0005 - Basic HVAC Requirements.

D. Section 23 0553 - Identification for HVAC Piping and Equipment.

E. Section 23 0800 - Commissioning of HVAC.

F. Section 23 0913 - Instrumentation and Control Devices for HVAC.

G. Section 23 0915 - Variable Frequency Drives.

H. Section 23 2123 - Hydronic Pumps.

I. Section 23 3300 - Air Duct Accessories.

J. Section 23 3423 - HVAC Power Ventilators.

K. Section 23 5233.13 - Finned Water-Tube Boilers.

L. Section 23 7223 - Packaged Air-to-Air Energy Recovery Units.

M. Section 23 7413 - Packaged Outdoor Central-Station Air-Handling Units.

N. Section 23 8148 - Water Source Heat Pumps.

O. Division 26 - Electrical.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 PRODUCT INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 23 0913 - Instrumentation and Control Devices for HVAC:

1. Duct static pressure sensors

2. H2O Pressure Differential/Flow Switches

B. Section 28 4600 - Fire Detection and Alarm:

1. Smoke Detectors/Fire Stats

1.5 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. General:

1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Section 23 3600 - Air Terminal Units:

1. VAV boxes: VAV Terminal Units shall be furnished configured to accept control inputs from an external building automation system controller as specified in Section 23 09 93. Factory mounted safeties and other controls shall not interfere with this controller.

C. Section 23 8000 - Decentralized HVAC Equipment:

1. Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller. Factory mounted safeties and other controls shall not interfere with this controller.

D. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a open protocol network interface for integration into the Direct Digital Control System described in this section.

1.6 DESCRIPTION

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. The system shall directly control HVAC equipment as detailed on the drawings. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified in the sequence.

C. System shall use open protocol communications to the operator workstation or web server and for communication between control modules.

1.7 APPROVED CONTROL SYSTEMS INSTALLERS

A. Michigan Environmental Controls.

B. Metro Environmental.

C. Johnson Controls.

D. Trane.

E. BASS.

F. Siemens.

G. Honeywell.

H. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless the Owner approves use of multiple manufacturers.

1.8 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with the Control System Manufacturer.

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

B. Perform work in accordance with NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.9 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)

2. International Building Code (IBC)

a. Section 719 Ducts and Air Transfer Openings

b. Section 907 Fire Alarm and Detection Systems

c. Section 909 Smoke Control Systems

d. Chapter 28 Mechanical

3. International Mechanical Code (IMC)

4. ANSI/ASHRAE 135-2004: Data Communication Protocol for Building Automation and Control Systems (BACNET)

1.10 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.

2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.

3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.

4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.

5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.

7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.

8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.

9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy as listed below:

   a. Space Temperature: +/- 1 degrees F

   b. Ducted Air: +/- 1 degrees F

   c. Outside Air: +/- 2 degrees F

   d. Dew Point: +/- 3 degrees F

   e. Water Temperature: +/- 1 degrees F

   f. Delta-T: +/- 0.25 degrees F

   g. Relative Humidity: +/- 5% RH

   h. Water Flow: +/- 2% of full scale

   i. Airflow (terminal): +/- 10% of full scale

      1) Accuracy applies to 10% - 100% of scale

   j. Airflow (measuring stations): +/- 5% of full scale

   k. Air Pressure (ducts): +/- 0.1 in. w.g.

   l. Air Pressure (space): +/- 0.01 in. w.g.

   m. Water Pressure: +/- 2% of full scale

      1) For both absolute and differential pressure

   n. Electrical (A, V, W, Power Factor): +/- 1% of reading

      1) Not including utility supplied meters

   o. Carbon Monoxide (CO): +/- 5% of reading

   p. Carbon Dioxide (CO_2): +/- 50 ppm

10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances as listed below:

    a. Air Pressure (0 to 6 in. w.g.): +/- 0.2 in. w.g.

    b. Air Pressure (-0.1 to 0.1 in. w.g.): +/- 0.01 in. w.g.

    c. Airflow: +/-10% of full scale

    d. Space Temperature: +/- 2.0 degrees F

    e. Duct Temperature: +/- 3 degrees F

    f. Humidity: +/- 5% RH

    g. Fluid Pressure (1 to 150 psi): +/- 1.5 psi

    h. Fluid Pressure (0 to 50 in. w.g. differential): +/- 1.0 in. w.g.

1.11 SUBMITTALS

A. Direct Digital Control System Hardware

1. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.

2. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

    a. Direct digital controllers (controller panels)

    b. Transducers and transmitters

    c. Sensors (include accuracy data)

    d. Actuators

    e. Valves

    f. Relays and switches

    g. Control panels

    h. Power supplies

    i. Batteries

    j. Operator interface equipment

    k. Wiring

3. Wiring diagrams and layouts for each control panel. Show termination numbers.

4. Floor plan schematic diagrams indicating field sensor and controller locations.

5. Riser diagrams showing control network layout, communication protocol, and wire types.

B. Central System Hardware and Software

1. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.

2. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

   a. Central Processing Unit (CPU) or web server

   b. Monitors

   c. Keyboards

   d. Power supplies

   e. Battery backups

   f. Interface equipment between CPU or server and control panels

   g. Operating System software

   h. Operator interface software

   i. Color graphic software

   j. Third-party software

3. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.

4. Network riser diagrams of wiring between central control unit and control panels.

C. Controlled Systems

1. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.

3. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

4. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.

5. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.12 WARRANTY

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.

2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

3. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

4. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.13 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics

2. Record drawings

3. Database

4. Application programming code

5. Documentation

PART 2 PRODUCTS

2.1 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATIONS

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise an open protocol internetwork.

B. Install new wiring and network devices as required to provide a complete and workable control network.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

E. Controllers with real-time clocks shall synchronize with the building management system. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

G. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.

2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.

3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.

4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

2.3 OPERATOR INTERFACE

A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. In addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.

2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.

3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.

4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

B. Communication. Web server or workstation and controllers shall communicate using an open protocol communications language. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.

C. Hardware. Each workstation or web server shall consist of the following:

1. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times as specified. Hard disk shall have sufficient memory to store system software, one year of data for trended points, and a system database at least twice the size of the existing database at system acceptance.

D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out. System shall require user name and password to log in to operator interface.

2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.

4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.

6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software.

1. Operating System. Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris. Coordinate operating system type with the Owner.

2. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a user name and password to view, edit, add, or delete data.

    a. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.

    b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

    c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as detailed on the drawings.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk.

12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:

    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

        1) Alarm History.

        2) Trend Data. Operator shall be able to select trends to be logged.

        3) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

    a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.

    b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

    c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

    d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

    e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

    f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

    g. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.

        1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

G. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

2.4 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling. System shall provide the following schedule options as a minimum:

1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.

3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

C. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

D. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).

E. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).

F. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

G. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits.

H. Sequencing. Application software shall sequence chillers, boilers, and pumps as detailed on the drawings.

I. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

J. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

K. Energy Calculations.

1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.

2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

L. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

M. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

N. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit.

2.5 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified.

B. Communication.

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.

4. Stand-Alone Operation. Each piece of equipment specified shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

C. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).

2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

D. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability.

1. Controllers shall have diagnostic LEDs for power, communication, and processor.

2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.

3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory.

1. Controller memory shall support operating system, database, and programming requirements.

2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.

3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

2. Dielectric strength of 1000 V minimum

3. Response time of 10 nanoseconds or less

4. Transverse mode noise attenuation of 65 dB or greater

5. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Local Control Panels.

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.

2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.

3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

2.10 FIBER OPTIC CABLE SYSTEM

A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.

B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

PART 3 EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 0923 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.

2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.

2. Train Test and Balance Contractor to use control system interface tools.

3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.

4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

C. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as indicated on drawings.

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as indicated on drawings.

3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

D. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Communication media and equipment shall be provided as specified.

2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation detailed on the drawings.

3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.

4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 FILED QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.

B. Continually monitor field installation for code compliance and workmanship quality.

C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 WIRING

A. The control contractor shall be responsible to provide additional 120V power as required for temperature controls and building automation. Some circuits may be indicated on the electrical drawings (if applicable) or provided from existing controllers being removed. If additional circuits are required, coordinate with the electrical contractor and/or owner's representative for locations of available circuits and provide circuit breakers, wiring and conduit as necessary.

B. The control contractor shall be responsible to provide low-voltage power supplies, wiring, conduit, etc. as necessary to power control, metering and monitoring devices.

C. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

D. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

E. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

F. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

G. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

H. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

I. Do not install wiring in raceway containing tubing.

J. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.

K. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

L. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

M. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

N. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

O. Use color-coded conductors throughout.

P. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

Q. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

R. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

S. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

T. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

U. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

V. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

W. Install signal and communication cable according to DDC system recommendations.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway. Wiring and cable in mechanical rooms shall be installed in conduit.

3. Install concealed cable in raceway.

4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

8. Low voltage cabling shall be run separate from 120 volt control wiring.

9. Input and output wiring shall be run in separate conduit systems.

10. Analog inputs shall be run separate from digital inputs.

11. Network cabling shall be run in separate conduit system.

12. No control wiring splices are allowed.

3.7 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring.

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 FIBER OPTIC CABLE

A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.9 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m2 (1 ft2) of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.

4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.

6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 WARNING LABELS

A. Affix permanent warning labels to equipment that can be automatically started by the control system.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows.

   a. C A U T I O N: This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing

B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.

   1. Labels shall use white lettering (12-point type or larger) on a red background.

   2. Warning labels shall read as follows.

      a. C A U T I O N: This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.11 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

B. Permanently label or code each point of field terminal strips to show instrument or item served.

C. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

D. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

E. Label room sensors related to terminal boxes or valves with nameplates.

F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

G. Label identifiers shall match record documents.

3.12 PROGRAMMING

A. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.

   1. Application Programming. Provide application programming that adheres to the sequences of operation. Program documentation or comment statements shall reflect language used in sequences of operation.

   2. System Programming. Provide system programming necessary for system operation.

B. Operator Interface.

1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points. Point information on graphics shall dynamically update.

2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation).

3.13 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.

2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.

3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.

4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.

5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.

6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.

7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.

8. Alarms and Interlocks.

a. Check each alarm with an appropriate signal at a value that will trip the alarm.

b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.

c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.14 CLEANING

A. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.15 TRAINING

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.

1. Proficiently operate system
2. Understand control system architecture and configuration
3. Understand DDC system components
4. Understand system operation, including DDC system control and optimizing routines (algorithms)
5. Operate workstation and peripherals
6. Log on and off system
7. Access graphics, point reports, and logs
8. Adjust and change system setpoints, time schedules, and holiday schedules
9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
10. Understand system drawings and Operation and Maintenance manual
11. Understand job layout and location of control components
12. Access data from DDC controllers
13. Operate portable operator's terminals
14. Create and change system graphics
15. Create, delete, and modify alarms, including configuring alarm reactions
16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
17. Configure and run reports
18. Add, remove, and modify system's physical points

19. Create, modify, and delete application programming

20. Add operator interface stations

21. Add a new controller to system

22. Download firmware and advanced applications programming to a controller

23. Configure and calibrate I/O points

24. Maintain software and prepare backups

25. Interface with job-specific, third-party operator software

26. Add new users and understand password security procedures

C. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.

1. Day-to-day Operators (objectives 1-13)

2. Advanced Operators (objectives 1-13 and 14-23)

3. System Managers and Administrators (objectives 1-13 and 24-26)

D. Provide course outline and materials according to Section 23 09 23 Article 1.10 (Submittals). Provide one copy of training material per student.

E. Instructors shall be factory-trained and experienced in presenting this material.

F. Perform classroom training using a network of working controllers representative of installed hardware.

SECTION 231123
NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting.

C. Section 230516 - Expansion Fittings and Loops for HVAC Piping.

D. Section 230553 - Identification for HVAC Piping and Equipment.

E. Section 312316 - Excavation.

F. Section 312316.13 - Trenching.

G. Section 312323 - Fill.

H. Section 335216 - Gas Hydrocarbon Piping.

1.3 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

C. ANSI Z223.1 - National Fuel Gas Code; 2021.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G. ASME B31.1 - Power Piping; 2022.

H. ASME B31.9 - Building Services Piping; 2020.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

P. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

Q. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

R. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

S. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2. Joints: ASME B31.1, welded.

B. Copper Tubing: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.

2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

3. Mechanical Press Sealed Fittings: Double-pressed type and approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

C. Flexible Gas Piping:

1. Pre-Sleeved Corrugated Stainless Steel Tubing: Comply with ANSI LC1 / CSA 6.26.

2. System shall be sleeved in a fully vent-capable polyethylene sleeve. Fittings shall have plastic containment coupling and 1/4" vent port.

3. Fittings: Provided by piping system manufacturer.

4. Manufacturers:

a. Omega Flex, Inc: www.omegaflex.com/#sle.

D. Polyethylene Pipe: ASTM D2513, SDR 11.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.

2. Joints: Fusion welded.

2.2 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type.

2. Joints: ANSI Z223.1, welded.

3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. Flexible Gas Piping:

1. Pre-Sleeved Corrugated Stainless Steel Tubing: Comply with ANSI LC1 / CSA 6.26.

2. System shall be sleeved in a fully vent-capable polyethylene sleeve. Fittings shall have plastic containment coupling and 1/4" vent port.

3. Fittings: Provided by piping system manufacturer.

4. Manufacturers:

a. Omega Flex, Inc: www.omegaflex.com/#sle.

b. Substitutions: See Section 016000 - Product Requirements.

C. Polyethylene Pipe: ASTM D2513, SDR 11.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.

2. Joints: Fusion welded.

2.3 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: Threaded or welded to ASME B31.1.

3. Exterior Applications Only: Mechanical Press Sealed Fittings (Where approved by local AHJ): Double-pressed type and approved or certified, utilizing EPDM/HNBR, nontoxic, synthetic rubber sealing elements.

a. Manufacturers:

1) Viega LLC: www.viega.us/#sle.

2) Nibco: www.nibco.com

3) Substitutions: See Section 016000 - Product Requirements.

b. Listings and Certifications:

1) ANSI LC-4/CSA 6.32

2) ICC-ES PMG 1502

3) IAPMO/UPC LC-4

2.4 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

a. Bases: High density polypropylene.

b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.6 BALL VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.

2. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.

3. Nibco, Inc: www.nibco.com/#sle.

4. Jomar Valves: www.jomarvalve.com

5. Bonomi: www.bonominorthamerica.com

6. Substitutions: See Section 016000 - Product Requirements.

B. Construction, 2 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or hot forged brass body, 304 stainless steel or chrome plated brass or bronze ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.

2.7 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:

1. Maxitrol Company: www.maxitrol.com/#sle.

2. Fisher

3. Eaton

4. Harper Wyman Co

5. Pietro Fiorentini

6. Substitutions: See Section 016000 - Product Requirements.

B. Compliance Requirements:

1. Appliance Regulator: ANSI Z21.18/CSA 6.3.

2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

C. Provide with inlet and outlet pressure gage on piping.

D. Regulator shall be capable of downturn from 10 psi (or max pressure required by Utility Company) to median pressure range of equipment served.

E. Regulator to be "ventless" where installed indoors, as approved by AHJ.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

K. Install valves with stems upright or horizontal, not inverted.

L. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813.

N. Sleeve pipes passing through partitions, walls and floors.

O. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Provide copper plated hangers and supports for copper piping.

3. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

P. Underground piping shall be installed with warning tape that states: "WARNING BURIED GAS LINE BELOW." The tape shall be in trench at least 12 inches above the gas piping.

3.2 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Provide regulators at all pieces of equipment in project. Optionally, line regulators can be provided to protect groups of equipment from abnormal conditions that may cause pressure increases, including but not limited to unusual operating conditions of the Utility service regulator.

C. Provide with drip leg and isolation valve as required by IFGC.

D. For interior buried applications, utilize pre-sleeved CSST with accessories or provide vented conduit encasement as required by IFGC.

3.3 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with local Utility requirements. Gas service distribution piping to have initial minimum pressure indicated on plans.

B. Contractor is responsible for coordinating new service with Utility, including any elevated pressure requests.

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SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Geothermal heat pump loop water piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

1.2 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

B. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

C. Section 220719 - Plumbing Piping Insulation.

D. Section 230523 - General-Duty Valves for HVAC Piping.

E. Section 230553 - Identification for HVAC Piping and Equipment.

F. Section 230719 - HVAC Piping Insulation.

G. Section 232114 - Hydronic Specialties.

H. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM B32 - Standard Specification for Solder Metal; 2020.

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

H. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

I. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

J. AWWA C606 - Grooved and Shouldered Joints; 2022.

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Include data on pipe materials, pipe fittings,and accessories.

2. Show grooved joint couplings, fittings, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

C. Coupling Manufacturer:

1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.

2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.

D. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.6 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Grooved mechanical joints may be used in accessible locations only.

   a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.

   b. Use rigid joints unless otherwise indicated.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.

2.2 GEOTHERMAL HEAT PUMP LOOP WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

2. Threaded Joints: ASME B16.3, malleable iron fittings.

3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or Type L, hard drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.

   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

a. Manufacturers:

1) Apollo Valves: www.apollovalves.com/#sle.

2) Grinnell Products: www.grinnell.com/#sle.

3) Viega LLC: www.viega.us/#sle.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.4 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.

3. Gaskets: 1/16 inch thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.

2. Mechanical Couplings: Comply with ASTM F1476.

3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.

4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

5. Manufacturers:

   a. Anvil International: www.anvilintl.com/#sle.

   b. Grinnell Products: www.grinnell.com/#sle.

   c. Victaulic Company: www.victaulic.com/#sle.

   d. Substitutions: See Section 016000 - Product Requirements.

D. Dielectric Connections:

1. Waterways:

   a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.

   b. Dry insulation barrier able to withstand 600-volt breakdown test.

   c. Construct of galvanized steel with threaded end connections to match connecting piping.

   d. Suitable for the required operating pressures and temperatures.

2. Flanges:

   a. Dielectric flanges with same pressure ratings as standard flanges.

   b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.

   c. Dry insulation barrier able to withstand 600-volt breakdown test.

   d. Construct of galvanized steel with threaded end connections to match connecting piping.

   e. Suitable for the required operating pressures and temperatures.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 232500 for additional requirements.

3.2 PIPING APPLICATIONS

A. Geothermal heat pump water piping, above ground:

1. Pipe sizes 3/4" - 2": Copper, soldered/brazed, or press joints; schedule 40 black steel threaded joints.

2. Pipe sizes 2 1/2" and larger: Schedule 40 black steel, welded or grooved joints.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Grooved Joints:

1. Install in accordance with the manufacturer's latest published installation instructions.

2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

J. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

3. Place hangers within 12 inches of each horizontal elbow.

4. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Provide copper plated hangers and supports for copper piping.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100 .

M. Use eccentric reducers to maintain top of pipe level.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

O. Install valves with stems upright or horizontal, not inverted.

3.4 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 4 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.

2. Inspect pumps for proper rotation. Set makeup pressure-reducing valves for required system pressure.

3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).

4. Set temperature controls so all coils are calling for full flow.

5. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

6. Verify lubrication of motors and bearings.

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SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Suction diffusers.

F. Pump connectors.

G. Combination pump discharge valves.

H. Relief valves.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

B. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com/#sle.

2. ITT Bell & Gossett: www.bellgossett.com/#sle.

3. Taco, Inc: www.taco-hvac.com/#sle.

4. Wessels: www.westank.com

5. Grundfos: www.grundfos.com

6. Substitutions: See Section 016000 - Product Requirements.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm or bladder sealed into tank, and steel support stand.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com/#sle.

2. ITT Bell & Gossett: www.bellgossett.com/#sle.

3. Taco, Inc: www.taco-hvac.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

2.3 AIR SEPARATORS

A. Coalescing Air/Dirt Separators:

1. Manufacturers:

a. Armstrong International, Inc: www.armstronginternational.com/#sle.

b. ITT Bell & Gossett: www.bellgossett.com/#sle.

c. Spirotherm, Inc: www.spirotherm.com/#sle.

d. Caleffi: www.caleffi.com.

e. Taco: www.tacocomfort.com.

f. Wessels: www.westank.com

g. Grundfos: www.grundfos.com

h. Substitutions: See Section 016000 - Product Requirements.

2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi operating pressure and 270 degrees F maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.

3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.

4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to the top of the separator.

5. Inlet and Outlet Connections: Threaded for 2 NPS and smaller; Class 150 flanged connections for 2-1/2 NPS and larger.

6. Blowdown Connection: Threaded.

7. Size: Match system flow capacity.

8. Accessories:

a. Provide with magnetic insert.

b. Comprised of neodymium 45H magnets with a strength of 13,550 Gauss, the magnetic rod helps remove metallic sediment that can pose a serious threat to modern system components. The insert can be easily moved from its position inside the separator to facilitate blow down and sediment removal.

2.4 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com/#sle.

2. Grinnell Products: www.grinnell.com/#sle.

3. The Metraflex Company: www.metraflex.com/#sle.

4. Titan Flow Control: www.titanfci.com.

5. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:

1. Provide flanged iron body for 175 psi working pressure, Y pattern with 1/16 inch stainless steel perforated screen.

D. Size 5 inch and Larger:

1. Provide flanged iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.5 SUCTION DIFFUSERS

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.

2. ITT Bell & Gossett: www.bellgossett.com/#sle.

3. Victaulic Company of America: www.victaulic.com/#sle.

4. Taco: www.tacohvac.com.

5. Grundfos: www.grundfos.com

6. Substitutions: See Section 016000 - Product Requirements.

B. Fitting: Angle pattern, cast-iron or ductile-iron body, threaded for 2 inch and smaller, flanged or grooved for 2-1/2 inch and larger, rated for 175 psi working pressure, with full-length, 4-plane removable straightening vanes made of carbon steel or 304 stainless steel, orifice cylinder shall be made of either carbon steel or 304 stainless steel, full-length cylinder strainer with 3/16 inch diameter openings, and 16 mesh full-length removable startup screen.

C.

D. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.6 PUMP CONNECTORS

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.

2. The Metraflex Company: www.metraflex.com/#sle.

3. Victaulic: www.victaulic.com.

4. Substitutions: See Section 016000 - Product Requirements.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure: 175 psig at 200 degrees F.

2. End Connections: Same as specified for pipe jointing.

3. Provide pump connector with integral vanes to reduce turbulent flow.

4. Provide necessary accessories including, but not limited to, swivel joints and limit stops.

2.7 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.

2. Crane Co.: www.craneco.com/#sle.

3. Taco, Inc: www.taco-hvac.com/#sle.

4. Victaulic Company of America: www.victaulic.com/#sle.

5. ITT Bell & Gossett: www.bellgossett.com/#sle..

6. Grundfos: www.grundfos.com

7. Substitutions: See Section 016000 - Product Requirements.

B. Valves: Straight or angle pattern, flanged or grooved cast-iron or ductile-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded brass or bronze disc with EPDM rubber seat, stainless steel stem and spring, and calibrated adjustment permitting flow regulation.

C. The valve shall have a calibrated nameplate with multi-turn stem.

D. The valve shall include a rubber memory button to allow the valve to be re-balanced to its original position after shut-off or maintenance.

E. The valve shall have a fully backseating disc to allow the valve packing to be replaced while under pressure.

F. The valve shall have a maximum temperature rating of 250°F (121°C).

G. Accessories:

1. Pressure/Temperature port.

2.8 RELIEF VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.

2. Armstrong International, Inc: www.armstronginternational.com/#sle.

3. ITT Bell & Gossett: www.bellgossett.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blowdown connection.

G. Support pump fittings with floor-mounted pipe and flange supports.

H. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

J. Pipe relief valve outlet to nearest floor drain.

K. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

L. Clean and flush glycol system before adding glycol solution. Refer to Section 232500.

M. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

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SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System lubricated circulators.

B. In-line circulators.

C. Base-mounted pumps.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230719 - HVAC Piping Insulation.

C. Section 232113 - Hydronic Piping.

D. Section 232114 - Hydronic Specialties.

E. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.

C. Taco: www.tacohvac.com.

D. Grundfos: www.grundfos.com

E. Substitutions: See Section 016000 - Product Requirements.

2.2 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.3 SYSTEM LUBRICATED CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psi maximum working pressure, 230 degrees F maximum water temperature.

B. Casing: Cast iron with flanged pump connections.

C. Impeller, Shaft, Rotor: Stainless Steel.

D. Bearings: Metal Impregnated carbon (graphite) and ceramic.

E. Motor: Impedance protected, multiple speed, with external speed selector.

2.4 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi maximum working pressure.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Oil-lubricated bronze sleeve.

E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

2.5 BASE-MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, or ductile iron with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

I. Motor: TEFC, NEMA premium efficiency, with factory installed Aegis shaft grounding rings.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and strainer or pump suction fitting on pump suction, and line sized combination pump discharge valve or soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base-mounted pumps prior to start-up.

H. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.

I. Lubricate pumps before start-up.

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SECTION 232500
HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials.

1. System cleaner.

2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Glycol solution.

D. Glycol feed unit.

1.2 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Owner furnished treatment equipment.

B. Section 232113 - Hydronic Piping.

C. Section 232114 - Hydronic Specialties.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

F. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

G. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Sufficient chemicals for treatment and testing during required maintenance period.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AmSolv-Amrep, Inc: www.amsolv.com/#sle.

B. GE Water & Process Technologies: www.gewater.com/#sle.

C. Nalco, an Ecolab Company: www.nalco.com/#sle.

D. H-O-H Water Technologies, Inc.

E. Substitutions: See Section 016000 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

2.3 MATERIALS

A. System Cleaner:

1. Manufacturers:

a. As recommended by chemical treatment manufacturer..

2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.

B. Closed System Treatment (Water):

1. Sequestering agent to reduce deposits and adjust pH.

2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

3. Conductivity enhancers; phosphates or phosphonates.

2.4 BY-PASS (POT) FEEDER

A. Manufacturers:

1. Griswold Controls: www.griswoldcontrols.com/#sle.

2. J. L. Wingert Company: www.jlwingert.com/#sle.

3. Neptune, a brand of the Dover Company: www.neptune1.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. 2 quart quick opening cap for working pressure of 175 psi.

2.5 GLYCOL SOLUTION (CHILLER SYSTEM/BOILER SYSTEM)

A. Furnish Dow Chemical Dow-Frost, Interstate Chemical Intercool or approved equal factory inhibited propylene glycol to fill the chiller loop with a blend of 30% propylene glycol and 70% deionized water. The solution shall contain a fluorescent dye to facilitate leak detection.

B. The solution shall be pre-mixed at the manufacturers factory with the appropriate inhibitors, buffers, and deionized water which meets the following industry standards for water quality: Less than 25 PPM sulfate: less than 25 PPM chloride; less than 50 PPM sodium; less than 1 PPM magnesium and less than 1 PPM calcium.

C. Under no circumstances should tap water or raw water be added to the system initially for make-up requirements.

D. Supplier must notify customer by written correspondence each (6) months form the date of delivery reminding the customer that the fluid should undergo chemical analysis to ensure the fluid is operating within industry standards for corrosion protection, pH, reserve alkalinity, degradation products and contamination identification if present. Supplier will analyze at no cost to the custom on a bi-annual basis and make available for purchase additive packages for remediation of the coolant if required.

2.6 GLYCOL MAKE-UP UNIT (CHILLER SYSTEM/BOILER SYSTEM)

A. Manufacturers:

1. Wessels Company

2. J.L. Wingert

3. Advanatge Controls

4. Bell and Gossett

B. General

1. Furnish and install one (1) simplex Glycol Feed System to automatically control the addition of propylene glycol into the closed chilled and hydronic heater water system.

2. The system shall be designed to maintain a consistant operating pressure in the closed loop and automatically feed a diluted glycol/water mixture to the system expansion tank as required by the system demand.

C. Equipment

1. One 50 or 55 gallon polyethylene dilution tank with tank level markings in 5-gallon increments, a welded steel support stand with pump mounting base, a removable polyethylene half-hinged cover, suction tubing with strainer, discharge piping with shut-off valve, check valve, pressure switch, system tee, pressure relief valve with relief tubing return to tank and a tank drain fitting.

2. A "Low Level" Alarm Switch shall be provided in the dilution tank. The switch shall function to activate an alarm bell/an alarm light and to shut down the glycol feed pump on low liquid level in the tank.

3. One glycol feed pump direct driven by an open dripproof motor. Pump construction shall consist of a bronze body, stainless steel shaft, positive spring loaded buna lip seal with temperature rating of 250 degrees F, self-lubrication carbon bearings self-priming from a dry start and shall be capable of lifting water on the suction side up to 20 feet. Pumping capacity shall be rated for minimum 60 PSI discharge pressure.

4. One NEMA 1 control panel shall be furnished mounted on the dilution tank support frame. It shall contain all the operating controls for the system including: a 0-30 PSI pressure gauge; an alarm circuit that will allow the operator to manually silence the bell but leave the visual alarm glowing until the low level condition is corrected; an automatic start/stop circuit for the pump activated by the pressure switch; an H-O-A selector switch; a power disconnect switch and all required internal wiring.

5. A 110V signal shall be available for remote alarm to BMS upon low level in the tank.

D. Service

1. The equipment supplier shall provide start-up services which shall include technical assistance to the contractor during installation and start-up and adjustment of the equipment following installation.

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. The mechanical contractor shall meter the initial water fill for the purpose of hydrostatic pressure testing and/or system flushing. After completion of this requirement the water shall be metered out. This will provide the contractor with a precise measure of coolant required to fill the system as well as the amount of water trapped in the system. This process will allow for any adjustments required prior to delivery of the premixed glycol solution and ensure that the solution strength is in compliance with the specification.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:

1. As recommended by manufacturer.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.

2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.

3. Circulate for 6 hours at design temperatures, then drain.

4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:

1. Circulate for 48 hours, then drain systems as quickly as possible.

2. Refill with clean water, circulate for 24 hours, then drain.

3. Refill with clean water and repeat until system cleaner is removed.

D. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

3.5 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.

2. Have operation and maintenance data prepared and available for review during training.

3. Conduct training using actual equipment after treated system has been put into full operation.

3.6 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

SECTION 232610
EXTERIOR GROUND LOOP HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Ground Heat Exchanger installation methods and requirements.

1.2 DESCRIPTION

A. This section shall include providing exterior underground heat pump heat exchangers. The extent of ground heat exchanger work is indicated on the drawings and schedules, and by the requirements of this section. The buried heat exchangers consist of high density polyethylene heat fusion-joined piping formed into vertical loops. The loops are connected with headers and prefabricated vertical heat exchanger u-bend assemblies.

1.3 REFERENCE STANDARDS

A. ASHRAE 1995 Commercial/Institutional Ground Source Heat Pump Engineering Manual (ISBN 1-883413-21-4)

B. ASHRAE 1997 Ground Source Heat Pumps: Design of Geothermal Systems for Commerical and Institutional Buildings. (S.P. Kavanaugh and K. Rafferty) (ISBN 1-883413-52-4)

C. IGSHPA 2009 Ground Source Heat Pump Residential and Light Commercial Design and Installation Guide

D. IGSHPA 2009 Closed Loop/Geothermal Heat Pump Systems Design and Installation Standards

E. IGSHPA 1988 Closed Loop/Ground-Source Heat Pump Systems Installation Guide

F. IGSHPA 1989 Soil and Rock Classification for the Design of Ground-Coupled Heat Pump Systems - Field Manual

G. IGSHPA 1991 Grouting Procedures for Geothermal Heat Pump Systems

H. IGSHPA 1997 Geothermal Heat Pump System Design Training for Architects and Engineers - Appendices and Manual

I. EPRI 1994 Water-Loop Heat Pump Systems Vol. 1, Rev. 1

J. Cost Containment for GSHP Systems by Steve Kavanaugh & Christopher Gilbert

K. Grout Thermal Conductivity and Vertical Loop Design by C. P. Remund

L. National Ground Water Association's Guidelines for the Construction of Vertical Boreholes for Clossed Loop Heat Pump Systems.

1.4 PERMITS

A. All work shall be permitted through the appropriate Authority Having Jurisdiction (AHJ). Owner and/or Owner's Representative shall be notified of all drilling related activities and shall receive a copy of the permit for review a minmum of 2 days prior to submission. Owner and/or Owner's Representative shall receieve copy of all drill logs. Contractor to include all permit and inspection fees in their bid.

1.5 WARRANTIES

A. Provide 50 year manufacturer's material warranty for HDPE piping loop. Provide installer's 2-year warranty on the piping installation.

1.6 SUBMITTALS

A. Shop Drawings: Show complete piping layout, depths of excavation, final depths of piping, backfill placement, point of entrance to building, test point locations, and fittings used for all joints and connections.

B. Shop Drawings and Product Data: Submit shop drawings and manufacturers' technical product data for all utility systems specified including all piping and appurtenances.

C. Include submittal for grout material and mix design.

D. Accurately record, on site plan, dimensioned "as built" drawing showing depth and location of horizontal piping and location of each bore, hole, measured from permanent fixture such as corner of building, fire hydrant, etc.

E. Certificates and Test Reports - Provide manufacturers' certificates of compliance (COC) and/or testing reports for pipes, tubing, horizontal heat exchangers, and appurtenances. Submit for review and approval prior to commencement of any pipe or loop installation.

F. Provide Installing Contractor's and Thermal Fusion Technician's records of qualification and related job experience.

G. Provide a copy of the supervising driller's Michigan water well license.

H. Submit manufacturer's technical data on fusion machine to be used in fabricating the ground heat exchanger.

I. Loop pressure test procedures and results. Procedures shall be approved prior to commencement of pressure test activities. Provide a 2 working day notification to the CM prior to conducting pressure tests.

J. Provide Owner or Owner's Representative with grout samples as requested during the ground heat exchanger installation.

K. Artesian Conditions

1. Installing contractor must have a written plan in place to address artesian groundwater condtions if encountered during drilling. Owner and/or Owner's Representative to recieve plan a minimum of 2 days prior to drilling for review.

1.7 QUALITY ASSURANCE

A. Installing Contractor must have a current IGSHPA accreditation, having completed an IGSHPA training course in the fundamentals of design, installation, and operation of geothermal systems, and having passed the IGSHPA accreditation examination and pipe fusion tests.

1. Preapproved Ground Heat Exchanger (GHX) Contractors:

a. Midwest Geothermal; 4546 Roger B Chaffee Memorial Blvd SE, Grand Rapids, MI 49548; phone: 616-514-1101; fax: 616-514-1125; Contact: Kortney Lull

b. Cribley Drilling Company; 8300 Dexter-Chelsea Road, Dexter, MI, 48130; phone: 734-426-4400; fax: 734-426-4414

2. Any contractor not included in the preapproved list above, will require approval by engineer. Coordinate selection of installing contrator with engineer.

B. The Drilling Contractor shall be a State licensed well driller. All drilling, looping, and grouting shall be done under the supervision of a state licensed well driller. As a minimum, state regulations and guidelines of the National Ground Water Association ashall be followed for the backfilling vertical bore holes. Backfill shall be evenly distributed throughout the entire bore to provide maximum heat transfer without voids.

C. Thermal Fusion Technician shall be certified by recognized certification agency and shall have field experience in forming thermally fused joints. Must have completed a polyethylene heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of an IGSHPA-accredited heat fusion technician, as part of an IGSHPA-approved manufacturing certification program, or under direct supervision of a DOT-certified heat fusion technician.

D. Manufacturer's Qualifications: Must be regularly engaged in the manufacture of GHP ground heat exchanger materials or fusion equipment for not less than five (5) years.

PART 2 - PRODUCTS

2.1 HEAT EXCHANGER

A. The ground-coupled heat exchanger has been designed. The ground heat exchanger contractor is responsible for execution as required in the Contract Documents.

2.2 MATERIALS AND MIXES

A. Grout: High-solids bentonite grout, bags labeled "Grout" ('GEL" label is not acceptable). Paddle mix grout with minimum shearing action and agitation of the slurry. See Section 23 2620.

2.3 FABRICATION AND MANUFACTURE

A. Ground Heat Exchanger (GHX) Piping and Fittings:

1. Materials: Virgin prime and comply with IGSHPA Standard I.C.3 for polyethylene and listed in PPI TR4 as a PE4710 piping formulation. See Section 23 2630.

B. Fittings shall be compatible with the pipe material or from the same material as the pipes.

C. Joints:

1. Thermally fused per IGSHPA Standards.

2. No joints in vertical tubing; maximum two joints at return U-bend.

D. Miscellaneous:

1. Markings: Pipe shall be marked with manufacturer's name and product name, nominal size, ASTM dimensional standard, PPI material classification, cell classification, sequential footage, and manufacturer's date code. Print line shall repeat every two feet.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection of Existing Utilities Structures. Protect the existing utilities shown on the drawings or the locations of which are known prior to excavation, from damage during excavation and backfilling of trenches and, if damaged, repair them at no expense to the Owner.

B. Any existing line or utility structure which is not shown on the drawings or the location of which is not made known in sufficient time to avoid damage, if inadvertently damaged, shall be repaired by the Contractor and an adjustment in payment will be made in accordance with "General Conditions".

C. Make repairs under the supervision of the utility concerned.

D. Fill U-bend loops with water and insert the U-bend into the bore to the depth stated in the design documents.

3.2 PREPARATION - EXCAVATION

A. General: Perform all excavation of every description and of whatever substances encountered, to the depths required or indicated on the drawings, in accordance with OSHA. See Section 31 2333 for details.

1. During excavation, deposit material suitable for backfill in an orderly manner a sufficient distance from the excavation banks to avoid overloading and to prevent slides or cave-ins. Dispose of drilling spoils and material unsuitable for backfill off site or as directed by the CM.

2. Grade as necessary to prevent surface water from flowing into trenches or other excavations, and remove any water accumulating therein by pumping or by other acceptable method.

3. Unless otherwise specified, all excavation shall be by open cut. Fill any excess excavation below the levels indicated for structures or pipe with sand as directed by the CM.

B. Trench Excavation: Excavate to provide a clear space on either side of the pipe to facilitate bedding as detailed on the Construction Drawings.

1. All header pipes to building and/or vault shall be provided with a minimum cover of five (5) feet.

2. Replace any material excavated beneath pipe entering and leaving the building and/or vault with sand and extend such fill to the center of pipe for a distance of at least 3 feet from face of the vault.

3. Unsuitable Material: Where the bottom of the trench is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic material, or large pieces of fragments of inorganic material, which in the judgement of the CM should be removed, excavate and remove such unsuitable material to a minimum depth of 6 inches below the pipe.

4. Backfill the trench with selected bedding material and compact to provide uniform and continuous bearing for the pipe per Article 3.04 of this Section. Dispose of the unsuitable material as directed by the CM.

C. Shoring Requirements: Perform all shoring and sheeting that is required to protect the excavation and to safeguard employees in accordance with OSHA. Widen excavation to provide for space occupied by shoring and sheeting.

D. Shoring shall meet the requirements of all applicable codes and regulations.

E. Dewatering: Do not allow water to accumulate in excavations. Prevent surface water and subsurface or ground water from flowing into excavations. Also provide silt fencing/straw bales around drainage structures to prevent runoff of drilling fluids/spoils into the storm and/or sewer systems.

F. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

G. Do not use trench excavations as temporary drainage ditches.

3.3 INSTALLATION

A. Excavation and drilling work shall be performed by qualified Contractors as defined in Part 1 above.

B. Pipe shall be installed in accordance with recommendations of ASHRAE and IGSHPA. Pipe joints shall be heat fusion type and shall be made as recommended by the pipe manufacturer.

C. Open ends of all pipe shall be sealed to prevent entry of contaminants until final connections are made. Tape is not an acceptable means of sealing pipe.

D. All piping shall be pressure tested per the sequncing and details listed in Section 23 2650.

E. Results of all tests shall be recorded and supplied to the CM upon completion of the project.

F. All final tests shall be witnessed by and the report signed by the CM. Provide minimum of 2 working days advance notice to the CM prior to testing.

G. Grouting: Vertical bore holes, as a minimum, be grouted in adherence with all state and local requirements and with the guidelines of NGWA. Since settling of the grouting material may occur after the initial grouting, Contractor shall monitor each bore hole and continue adding grout as required. Refer to Section 23 2620.

3.4 BACKFILL

A. General: Do not backfill trenches until all required inspections are made and tests are performed.

B. Backfill horizontal trenches with engineered fill sand in accordance with Section 31 2333. Broken concrete, gravel, and crushed stone shall not be used as backfill material for GHX piping.

1. Trenches under parking areas shall be completely backfilled and compacted with sand fill. Refer to trench details on Construction Documents.

2. Trenches under green space areas shall be backfilled with a minimum of 2'-0" of sand around the GHX piping. The remianing backfill shall may be clean excavated earth with no sharp rocks. Refer to trench details on Construction Documents.

C. Adjust the moisture content of the backfill material if required for proper compaction.

D. Reopen any trenches improperly backfilled, or where settlement occurs, to the depth required for proper compaction, refill and compact to specified density.

E. Compact all backfill for structures to the specified density.

F. Around Horizontal Pipe: Deposit backfill around the pipe in 12 inch layers and thoroughly compact. Refer to Section 31 2333. Be careful not to disturb the pipe. Perform back filling simultaneously on both sides of the pipe.

G. Remainder of Trench: Deposit specified backfill material in layers not exceeding 12 inches in loose depth and thoroughly compact each layer.

H. Bedding: Engineered fill sand shall be used for bedding.

I. Coordinate all backfill with Earthwork Specifications.

3.5 ELECTRONIC MARKER SYSTEM

A. Electronic marking devices shall be located over each vertical bore of the entire GHX as indicated on the Construction Drawings, and at each change change of direction of the piping mains (horizontal piping). The electrconic marker system shall consist of 3M Ball Markers engineered for narrow trench applications up to five feet in depth, 4-inch ball diameter, self-leveling feature ensuring accurate, horizontal position regardless of ground placement.

3.6 WARNING TAPE

A. Warning tape shall be of the type specifically manufactured for marking and locating underground utilities. The tape shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown. The tape shall be acid- and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch and shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise with an elongation factor of 350 percent. Tape shall bear a continuous printed inscription describing the service. Tape shall have integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion.

3.7 ADJUSTMENTS AND CLEANING

A. Pneumatic Pressure Test

1. Pneumatic pressure test to be completed at discression of installing contractor. Coordinate requirement with Owner/Owner's Representative.

2. Utilizing the procedures listed in Section 23 2650 and in compliance with IGSHPA recommendations, conduct a pneumatic pressure test on each circuit of the ground heat exchanger.

3. The pressure test shall be observed and approved by the CM and CxA

B. Flushing and Purging:

1. Configure flushing/purging unit as recommended by IGSHPA.

2. Utilize a portable temporary purging unit consisting of the following:

a. High volume, high head purge pump capable of maintaining the required purge velocity in all sections of the pipe.

b. Open reservoir with inlet and outlet valves and pressure gauge

c. Filter assembly with bypass

d. Flow meter

e. Pressure gauge

f. Connecting piping

g. Connecting hoses

3. Flush and purge each circuit as required to remove all dirt, contaminants, and air within the piping system with potable water until not dirty water or air bubbles are observed leaving the system.

4. Flush and purge using the recommended procedures as defined by IGSHPA. Mantain minimum of 2 feet per second through all pipe for a duration of 10 revolutions (minimum) in each direction of flow.

5. Notify CM, CxA, and Owner/Owner's Representative minimum 2 days before flushing and purging operation.

6. Water for flushing shall be provided by the owner at a location to coordinated with the CM. An adequate receptacle for the removal of the liquid shall be located and used. No dumping of water used for flushing at any ground surface area will be allowed unless prior approval is given by the Owner or the Owner's Representative.

7. Flusing and Purging shall be witnessed by the CxA

C. Flow Testing

1. Utilizing the flusing and purging unit inidicated in Section 3.08.A and in compliance with IGSHPA recommendations, conduct flow test (at designed flow rate for each circuit) on each circuit of the ground heat exchanger individully to ensure the system is free of blockages. If the flow test indicates blockage, locate the blockage using the manufacturer's recommendation, remove the blockage, then purge and conduct the pressure and flow test again until all portions of the system are free-flowing.

2. The flow test shall be observed and approved by the CM and CxA.

D. Hyrdonic Pressure Testing

1. Utilizing the flusing and purging unit inidicated in Section 3.08.A. or a separate pressure pump and the procedures listed in Section 23 2650 and in compliance with IGSHPA recommendations, conduct a pressure test on each circuit of the ground heat exchanger.

2. The pressure test shall be observed and approved by the CM and CxA.

3. Pressure testing to be witnessed by the AHJ.

3.8 REPORTS

A. The following reports shall be submitted to the CM, CxA, Engineer of Record, and Owner/Owner's Rep for information.

1. As-built site layout of loop, header, warning tape, installation locations and lengths.

    a. As-builts shall be provided with GPS coordinates of every bore hole and every change in direction of main piping.

2. Pressure test results.

3. Summary of drilling activities including:

    a. Boring Logs

    b. Discussion of grout mixture

    c. Method for adding grout

    d. Volume of grout added to borehole

    e. Record amount of settlement the day after grouting (not less than 12 hours after grouting)

    f. Volume of grout added to "top off" the borehole after settlement

    g. Verification that local permit requirements were followed

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SECTION 232620
THERMAL-ENHANCED BENTONITE GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Requirements for furnishing, mixing, and placing thermally-enhanced bentonite grout to seal and backfill each vertical u-bend well bore of the closed-loop ground heat exchangers to insure proper thermal contact with the earth and to ensure the environmental integrity of each vertical bore column. No other backfill material shall be accepted.

1.2 REFERENCES

A. IGSHPA 2009 - Ground Source Heat Pump Residential and Light Commercial Design and Installation Guide

B. IGSHPA 2009 Closed Loop/Geothermal Heat Pump Systems Design and Installation Standards

C. IGSHPA 1991 Grouting Procedures for Geothermal Heat Pump Systems

D. ASTM D-5334 Standard Test Methode for Termination of Thermal Conductivity of Soils and Soft Rock by Thermal Needle probe Procedure.

1.3 SUBMITTALS

A. Manufacturer's published data sheets including thermal conductivity, permeability, percent solids, grout weight, linear shrinkage potential, maximum particle size and unit yield along with verification of the required listing.

1.4 QUALITY ASSURANCE

A. Grouting compound and all grouting materials shall be certified and listed by National Sanitation Foundation International to ANSI/NSF Standard 60, “Drinking Water Treatment Chemicals - Health Effects”.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. GeoPro

B. Baroid

C. Wyoben

2.2 PRODUCT

A. Grouting: Materials to be utilized by the Contractor shall be a minimum of 20% high sodium solids bentonite grout. The bentonite will be a slurry that will be tremie grouted from the bottom of the boring to the surface in accordance with the IGSHPA installation manual. The contractor will work quickly to assure that there are no air voids forming as a result of the bentonite placing.

B. Thermal Enchancement Additive: The thermal enhancement additive shall be a graphite-based material. The material shall be provided by the grout manufacturer.

2.3 THERMAL CONDUCTIVITY

A. The thermal conductivity of the grouting compound must be 1.20 Btu/hr-ft-F or greater as determined when tested in accordiance to ASTM D-5334 IGSHPA Standard 2B3.2.1.

2.4 TOTAL SOLIDS AND ENHANCEMENT COMPOUND PERCENTAGE

A. The thermally-enhanced bentonite grout used shall have a minimum manufacturers recommended mixture of 32.4% solids and 26.4% active solids. The graphite based enhancement compounds shall constitue a minimum of 30% by weight of dry material (dry weight batch consists of grout, enhancement compound, and cement).

2.5 PACKAGING

A. Grouting materials (inclusive of the bentonite compnent and thermal enhacement additives shall be pre-manufactured and packaged prior to delivery to the job site.

PART 3 - EXECUTION

3.1 MIXING

A. Thermally-enhanced bentonite grouting material shall be mixed according to manufacturer's written instructions.

B. Contractor shall monitor the grouting operation to ensure grout is properly mixed and the viscosity is adequately maintained for pumping.

C. Grout shall be mixed by a paddle type mixing device or by manufactured portable grouting unit specifically designed for the vertical ground heat exchanger industry. Jet mixing and re-circulation are not allowed for grout.

D. Provide grout samples to CM, Owner, or Owner's Representative as requested.

3.2 INSTALLATION

A. Grout material shall be pressure pumped through a 1-1/4 in. or 1-1/2 in. inside diameter tremie pipe and placed in the bore column from the bottom to the top. Grouting process shall conform to the manufacturer's instructions. Completed grouted surface shall be placed at ground level to ensure complete fill of the bore column.

B. Contractor shall maintain a ready supply of spare grout pipes, hoses and fittings on the site.

C. A positive displacement pump shall be used for placing the grout in the horizontal slinky trench. Minimum pump suction and discharge lines shall be 3 inches and 1-1/2 inches respectively.

D. Drilling fluids shall be confined to the site and disposed of in accordance with prevailing local environmental regulations.

3.3 INSPECTION

A. Since some settling may occur after initial placement of the grout material, the Contractor shall monitor each trench and continue adding grout as required until no settling occurs.

B. Grouting manufacturer shall provide testing of site mixed grouting material to verify thermal conductivity. Manufacturer shall provide sample analyses.

1. At a minimum, sampling shall be taken at the beginning of the project, at approximately one-third completion, and at approximately two-thirds completion. In the event that the analysis indicates a thermal conductivity value below the minimum specified value, corrective action shall be taken to increase thermal conductivity value back.

2. Inspection results are to be provided to the CM, Owner's Representative, and Engineer for review. If testing indicates a grout conductivity lower than the design value, the Engineer will provide instructions for any corrective measures required.

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SECTION 232630
GROUND HEAT EXCHANGER PIPING & MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. HDPE pipe used for geothermal heat pump water loop installations.

1.2 REFERENCES

A. ASTM D1683, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

B. ASTM D2447, Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

C. ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-controlled Polyethylene Pipe and Tubing.

D. ASTM D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

E. ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

F. ASTM D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

G. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.

H. ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

I. ASTM F1055, Standard Specification for Electrofusion Type Polyethylene Fitting for Outside Diameter Controlled Polyethylene Pipe and Tubing.

J. PP MS-7, Model Specifications for Plasitc Piping Materials for Ground Source Geothermal Applications (latest edition).

1.3 SUBMITTALS FOR APPROVAL

A. Submit manufacturer's technical product data, quality control plan, and installation instructions for pipe and fittings.

B. Submit names and certificates of successful completion of manufacturer training for the application specified.

C. Submit manufacturer's technical data on fusion machine to be used in joining the pipe and fittings.

D. Copies of pipe and fitting warranties must be submitted.

PART 2 - PRODUCTS

2.1 PIPING

A. General: The pipe shall be virgin resin with an allowance for on-site manufacturer re-processed resin. No recycled resin shall be used. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D-2513, Sections 4.1 and 4.2. The material shall maintain a 1600 psi Hydrostatic Design Basis at 73.4 degrees F per ASTM D-2837, and shall be listed in PPI TR4 as a PE4710 piping formulation. The material shall be a high density extrusion compound having a cell classification of PE345434 or higher with a UV stabilizer of C, D, or E as specified in ASTM D-3350 with the following exception: this material shall exhibit zero failures (F0) when tested for a minimum of 192 hours under ASTM D-1693, Condition C, as required in ASTM D-3350.

B. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D-3035 or D-2447. Molded fittings(White/Drisco) shall be manufactured to dimensional specifications and requirements of (White/Drisco) ASTM D-2683 for socket fittings, ASTM D-3261 for butt/sidewall fittings, ASTM D-2513, Section 6.10.1 for Mechanical Stab fittings, and ASTM F-1055 for electrofusion fittings.

1. Pipe with a diameter of 2 inches or less shall be manufactured in accordance with ASTM D-3035 with a minimum dimension ratio of 11.

2. Pipe manufactured with a diameter of 3 inches and larger shall be manufactured in accordance with ASTM D-3035 and ASTM F714 with a minimum dimension ratio of 15.5, or ASTM D-2447 Schedule 40. If the pipe is used in a vertical bore application, it shall be manufactured in accordance with ASTM D-3035 with a minimum dimension ratio of 11.

C. U-Bend:

1. U-Bend coil shall be 1-1/4" make adjustable per project*and manufactured in accordance with ASTM D-3035 with a minimum dimension ratio of 11 .

D. Fittings: The geothermal system pipe fittings which are molded shall be manufactured to the dimensional specifications and requirements of ASTM D-3261 for butt/sidewall fittings. The material used in the manufacturing of the fitting shall be the same approved extrusion material as the connecting pipe. For fabricated fittings, a minimum 'quick-burst' strength of the fittings shall not be less than that of the pipe, nor less than four times the long-term water-rated working pressure.

E. Joints: The approved joints are heat fusion, flanging, transition fittings and proof-tested, approved mechanical "couplers". Fusion joints shall be made by trained and qualified construction crew staff.

1. The butt fusion machine used to make the joints shall encompass the following features:

a. Guide rods shall be in a plane that passes through the centerline of the pipe, thus canceling the bending forces in the machine caused by the fusion forces.

b. The pipe clamps shall have the strength to 'round-up' the pipe close to the fusion joint. They must be adjustable for removal of high/low mismatch of pipe walls and clamp each piece on continuing straight centerline.

c. The pipe facing device shall be capable of rapid facing of the pipe ends to a perfectly flat surface, so when the ends are brought together, there is 100 percent plastic contact.

d. The facer may be hand or electric powered for pipe sizes up to 2 inches (5.1 cm), and electrically powered for pipe sizes up to 8 inches (20.3 cm).

e. The facer shall have precisely machined stops to lock the facer squarely between the clamping jaws at the end of the face off.

f. The heater plate shall be electrically heated and thermostatically controlled. The surface shall be smooth with a high quality non-stick coating. The heater shall be capable of quick heat-up and maintaining a constant surface temperature in the desired temperature range even in inclement conditions. The heater plate shall be equipped with a thermometer to indicate temperature change. A surface pyrometer is used periodically to assure proper temperature. Use pipe manufacturer's recommended fusion temperature.

2. The socket fusion machine used to make the joints shall encompass the following features:

a. An electric, thermostatically-controlled heater plate. The surface shall be smooth and free of foreign material. The heating tool shall be capable of heating socket faces to the appropriate fusion temperatures as per manufacturer's recommendations.

b. A set of metal socket faces which are dimensionally accurate according to current industry practices. The surface of the socket face that will be in direct contact with the pipe or fitting shall be smooth and coated with a high quality non-stick coating.

c. Temperature-indicating crayons or a surface pyrometer. One temperature crayon shall be for the proper 'low' end temperature indication and another crayon shall be for indicating the 'high' end temperature. Use pipe manufacturer's recommended fusion temperature range.

d. A depth gauge that is sized according to pipe diameter and corresponding fusion fitting socket depth. The depth gauge shall be used to locate the cold ring the proper distance from the pipe end.

e. A metal locking cold ring clamp which supplies support for the entire circumference of the piping material. Cold ring shall have the ability to keep the pipe end round. The cold ring shall be used to limit the pipe depth entry into the socket face and fusion fitting socket.

f. A timing device that emits an audible tone and a timing light on one second intervals. Timer shall be used to determine proper heat cycle for the pipe and fitting. Use pipe manufacturer's recommended heating times.

g. A number of clean, dry, 100 percent cotton rags used to clean the socket heater faces after each fusion application. Rags shall be free of any cleaning solvents, grease, or dirt.

3. Install piping in accordance with manufacturer's written instructions. The pipe and fittings must be joined using the butt, socket, electrofusion, or fusion process. No other method is acceptable. The horizontal loop take-off tee fittings may be made using tees or the saddle fusion process on header piping 1.25 inch (3.18 cm) and above. Exercise extreme caution to completely remove the cutout on saddle tees. Bell reductions shall be used at all pipe reductions to eliminate trapped air.

4. Use reducing socket tees when fabricating socket type reducing headers. Consult with manufacturer for available fittings and fabricated headers.

5. Avoid sharp bends in piping. Consult pipe manufacturer for minimum bend radius. Install elbow fittings for bends which require tighter radii than manufacturer recommends. Use only continuous pipe in sharp bends.

F. Marking: Each pipe shall be permanently indent marked with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards, cell classification number and date of manufacture.

1. Each fitting shall be identified with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards and date of manufacturer.

2. Each vertical U-tube pipe shall have length markings at one foot increments.

G. Packaging, Handling, And Storage: The pipe and fittings shall be packaged, handled and stored in accordance with the approved manufacturer's general guidance and recommendations.

H. Minimum Water Pressure Ratings at 73.4 degrees F for PE 4710 Plastic Pipe per ASTM D3035:

1. Dimension Ratio 15.5 (SDR-15): 138 PSI

2. Dimension Ratio 11.1 (SDR-11): 200 PSI

3. Dimension Ratio 9.0 (SDR-9): 250 PSI

2.2 SOURCE QUALITY CONTROL

A. Obtain pipe and fittings from compatible manufacturers.

B. The pipe and fittings manufacturer shall have in place a functional quality assurance program. Such QC/QA programs shall deal with quality and workmanship, OA verification, OA rejection and have OA record retention systems in place.

C. The goethermal borehole coil (one coil per bore) shall come factory assembled, tested and pressurized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping system per specification section 23 2610.

B. Join pipe and fittings by approved methods described above.

3.2 PIPING APPLICATIONS

A. Geothermal Heat Exchanger Piping

1. U-Bends (vertical geothermal piping/coil)

a. 1 1/4": HDPE 4710 SDR-11

2. 2" or less: HDPE 4710 SDR-11

3. 3" and larger: HDPE 4710 SDR-15.5

B. Fittings

1. 1 1/4" and larger: HDPE 4710 SDR-11

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SECTION 232650
GROUND HEAT EXCHANGER PRESSURE & LEAK TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Pressure/leak testing of piping systems.

1.2 DEFINITIONS

A. Dry Oil-free Compressed Air (DCA): compressed air, oil free, with -40° to -75°F dew point at atmospheric pressure.

1.3 SUBMITTALS FOR APPROVAL

A. Test records for each piping system prepared during pressure/leak testing, indicating date of test, identification of piping system tested, test media, test pressure, and certification of results.

1.4 QUALITY ASSURANCE

A. Prepare test records for each system during pressure/leak testing, including date of test, identification of piping system tested, test media, test pressure, and certification of results. Individual test records need not be retained if certification that piping has satisfactorily passed pressure/leak testing is retained.

1.5 SEQUENCING

A. Perform testing on HDPE piping as follows:

1. With the pipe on the spool before installation (if the pipe has not been shipped under air pressure).

2. After placement of the U-bend in the ground.

3. After the header connections have been completed.

4. After mains have been installed from vault to building.

B. After completion of all testing, keep the entire system full of water and under pressure (~50 psi max) prior to connection to the building loop piping (at manifold isolation valves; refer to details).

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Calibration Date: maximum 12 months prior to test.

B. Use test equipment with label indicating serial number, calibration date, name of firm or laboratory performing calibration.

C. CM representative will examine test equipment prior to test. CM representative may require that test equipment be submitted to CM for calibration check. Test equipment failing calibration check must be submitted to an approved testing laboratory for proper calibration prior to use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine system installation for compliance with drawings and specifications.

B. Ensure pressure-relief valves have been inspected and set at required pressure by CM.

C. Ensure that rupture discs have been properly installed.

D. Examine system for leaks at valves, flanges, welds, connections, and joints.

E. Examine piping system for defective, broken, or cracked piping and fittings.

3.2 PREPARATION

A. Isolate or replace with spool pieces vessels, pumps, instruments, controls, safety valves, relief valves, and other equipment items rated for pressures below test pressure.

B. Provide temporary over pressurization protection devices between pressure source and test equipment.

C. For Class B - Hydrostatic Test, set temporary over pressurization protection devices at 130% of test pressure.

D. Disconnect or isolate by blinds or other means equipment that is not to be tested. Valves may be used provided valves are rated for test pressures.

E. Maintain joints, including welds and bonds, uninsulated and exposed for examination during testing. Joints previously tested may be insulated or covered.

F. Cover exposed horizontal HDPE piping at intervals, particularly at curves, to hold it in place during pressure testing.

G. Clear test area of personnel not involved with pneumatic testing.

3.3 REPAIR/RESTORATION

A. Repair leaks and retest repaired joints until test requirements have been satisfied.

3.4 CLASS A - PNEUMATIC TEST

A. Preliminary leak test procedure completed prior to flushing and purging

1. Gradually pressurize piping system to 25 psig.

2. Maintain 25-psig pressure for a minimum of 10 min.

3. Visually examine valves, flanges, welds, joints, and connections for major leaks.

3.5 CLASS B - HYDROSTATIC TEST

A. Test Media: potable water.

B. Test Pressure: 150% of design pressure or 100 psig, whichever is greater. Test pressure not to exceed pipe operating pressure rating.

C. Test Procedure

1. Complete flushing, purging and flow test as indicated in Section 232610.

2. Pressurization testing shall take minimum of 4 hours to allow for stabalization of expansions. When increasing pressure, allow stabalization and add pressure as required every 20 minutes.

a. First Hour - Maintain min, 80-100 PSI

b. Second Hour - Maintain min. 90-100 PSI

c. Third Hour - Maintain 110-120 PSI

d. Fourth Hour - Testing

1) Reduce pressure to 5% above test pressure.

2) Maintain pressure in system for min. 60 minutes +/- 5 PSI.

3. Examine valves, flanges, welds, joints, and connections for leaks.

4. Reconnect instruments and equipment.

5. Pressurize to maximum operating pressure, and examine valves, flanges, welds, joints, and connections for leaks.

D. Acceptance Criteria: No leakage is permitted at any joints. No leakage is acceptable at valves and gaskets unless specified otherwise.

3.6 DEMONSTRATION

A. Perform tests in presence of CM representative and CxA.

B. Perform tests in presence of AHJ.

3.7 REPORTS

A. All testing results shall be recorded including the following information:

1. Date, time, location.
2. Test duration.
3. Test results (pass/fail)
4. Corrective actions taken for "failed" tests.
5. Witness' signature (CM, CxA, Owner, or Owner's Representative)

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Ducts for kitchen exhaust applications.

C. Single-wall rectangular ducts and fittings.

D. Single-wall round ducts and fittings.

E. Sheet metal materials.

F. Sealants and gaskets.

G. Hangers and supports.

1.2 RELATED REQUIREMENTS

A. Division 07 - Thermal Moisture Protection: Firestopping

B. Section 230005 - Basic HVAC Requirements

C. Section 230713 - Duct Insulation: External insulation and duct liner.

D. Section 233300 - Air Duct Accessories.

E. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.

C. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

G. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

H. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

N. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

O. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

P. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide data for duct materials, duct connections, and factory fabricated fittings.

C. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accommodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

1.6 REGULATORY REQUIREMENTS

A. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; Current Edition including all Addenda.

PART 2 PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCT AND FITTING ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. McGill AirFlow LLC.

    b. Spiral Manufacturing Co., Inc.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

E. Tees and Laterals: Select types ansd fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 3 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant

6. Maximum Static-Pressure Class: 10-ing wg, positive and negative

7. Service: Indoor and outdoor

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg pressure class, positive or negative.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, "Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 METAL DUCTS

2.6 METAL DUCTS

A. Material Requirements:

1. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

3. Galvanealed Sheet Steel (FOR EXPOSED, PAINTED DUCTWORK): Comply with ASTM A653-09; hot dipped zinc iron coated steel, annealed, coating designation "A" (A60, A40)

4. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.

5. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

6. Stainless Steel: ASTM A480/A480M, Type 304 or 316.

B. Manufactured Ductwork and Fittings:

1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Fabrication:

1. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2. Provide turning vanes in all mitered elbows.

3. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

4. T's, bends, and elbows: construct according to SMACNA (DCS).

5. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

6. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

7. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.7 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:

1. Duct Size: 1/2 in-wc pressure class stainless steel.

2. Fabricate using single wall, 20-gauge, 0.035-inch Type 304 stainless steel with external welded joints.

3. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

F. Kitchen Hood and Grease Exhaust Duct:

1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.

2. Round, Single-Wall, Premanufactured Grease Exhaust Duct:

a. UL Listed and labeled to UL 1978.

b. Construct of 20-gauge, 0.035-inch Type 304 stainless steel.

c. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

d. Minimum horizontal slope of 1/16 inch per foot per manufacturers listing to UL 1978.

3. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:

a. UL Listed and labeled to UL 1978.

b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.

4. Round, Double-Wall, Premanufactured Grease Exhaust Ducts:

a. UL Listed and labeled to UL 1978.

b. Nominal 1 inch thick, body soluble fiber insulation that fills annular space between inner liner of 20-gauge, 0.035 inch Type 304 stainless steel and outer jacket of 24-gauge, 0.023-inch aluminized steel.

c. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

d. Minimum horizontal slope of 1/16 inch per foot per manufacturer's listing to UL 1978.

5. Zero Clearance, 2-Hour Fire-Rated, Round, Double-Wall, Premanufactured Grease Duct:

a. UL Listed and labeled to UL 1978 and UL 2221.

b. Nominal 3 inches thick, high density body soluble fiber insulation between 20-gauge, 0.035-inch Type 304 stainless steel liner, and 24-gauge, 0.0239-inch aluminized steel sheet outer jacket.

c. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

d. Through-penetration firestop listed to UL 1479 or ASTM E814.

e. Minimum horizontal slope of 1/16 inch per foot per manufacturers listing to UL 1978.

6. Zero Clearance, 2-Hour Fire-Rated, Rectangular, Double-Wall, Premanufactured Grease Duct:

a. Listed when tested in accordance with UL 1978 and ASTM E2336.

b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.

c. Liquidtight with continuous external weld for seams and joints.

d. Where ducts are not self-draining back to equipment, provide low-point drain pocket with copper drain pipe to sanitary sewer.

e. Through-penetration firestop listed to UL 1479 or ASTM E814.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

E. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

F. Install round ducts in maximum practical lengths.

G. Install ducts with fewest possible joints.

H. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

I. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

J. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

K. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

L. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

M. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

N. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

P. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

Q. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

R. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

S. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

T. Use double nuts and lock washers on threaded rod supports.

U. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

V. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

W. Louver Fit-out:

1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.

2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.

3.2 HANGERS AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.

4. Outdoor, Return-Air Ducts: Seal Class C.

5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

7. Unconditioned Space, Exhaust Ducts: Seal Class C.

8. Unconditioned Space, Return-Air Ducts: Seal Class B.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.

11. Conditioned Space, Exhaust Ducts: Seal Class B.

12. Conditioned Space, Return-Air Ducts: Seal Class C.

CLEANING

3.5 CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.6 FIELD QUALITY CONTROLS

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

b. Ducts with a Pressure Class 3-Inch wg and less do not need to be tested unless noted otherwise by Engineer in Contract Documents.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Keep open ends of ductwork covered during construction.

5. Test for leaks before applying external insulation.

6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCAACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

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SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connectors.

F. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project procedural and administrative requirements.

B. Division 07 - Thermal and Moisture Protection: Firestopping

C. Section 230005 - Basic HVAC Requirements

D. Section 233100 - HVAC Ducts and Casings.

E. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.6 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers:

1. Blade: 24 gage, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

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SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Cabinet exhaust fans.

C. Kitchen hood upblast roof exhausters.

1.2 RELATED REQUIREMENTS

A. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 233300 - Air Duct Accessories: Backdraft dampers.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.5 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. PennBarry, Division of Air System Components: www.pennbarry.com.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Comply with AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 ROOF EXHAUSTERS

A. Fan Unit: direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

2.4 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

E. Provide grille mounted motion switch with time delay for fan control.

2.5 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:

1. Fan Wheel:

a. Type: Non-overloading, backward inclined centrifugal.

b. Material: Aluminum.

2. Statically and dynamically balanced.

3. Motors:

a. Open drip-proof (ODP).

b. Heavy duty ball bearing type.

c. Mount on vibration isolators or resilient cradle mounts, out of air stream.

d. Fully accessible for maintenance.

4. Housing:

a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.

b. Rigid internal support structure.

c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.

d. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.

e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:

1. Fan Shaft:

a. Ground and polished steel with anti-corrosive coating.

b. First critical speed at least 25 percent over maximum cataloged operating speed.

2. Bearings:

a. Permanently sealed or pillow block type.

b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

c. 100 percent factory tested.

C. Drive Assembly:

1. Direct Drive

D. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, ventilated double wall, and factory installed nailer strip.

E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:

1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 220548.

2. Install flexible connections specified in Section 233300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated. Do not install dampers in grease duct.

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers:

1. Perforated ceiling diffusers.
2. Rectangular ceiling diffusers.

B. Registers/grilles:

1. Ceiling-mounted, egg crate exhaust and return register/grilles.
2. Wall-mounted, supply register/grilles.
3. Wall-mounted, exhaust and return register/grilles.

C. Duct-mounted supply and return registers/louvers.

D. Intake and Relief Louvers.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project provedural and administrative requirements.

B. Division 09 - Finishes: Painting of ducts and visible behind outlets and inlets.

C. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.3 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.5 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.1 DIFFUSERS, REGISTERS, GRILLES MANUFACTURERS

A. Krueger-HVAC: www.krueger-hvac.com.

B. Price Industries: www.price-hvac.com.

C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com.

D. Tuttle and Bailey: www.tuttleandbailey.com.

E. Shoemaker Manufacturing: www.shoemakermfg.com

F. Duravent (Hart & Cooley): www.hartandcooley.com

G. Substitutions: See Section 016000 - Product Requirements.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, plaque face diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As indicated.

F. Accessories: Provide radial opposed blade, butterfly, and combination splitter volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, anti-smudging device, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

2.3 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel frame and baked enamel finish.

D. Color: As indicated.

E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.4 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.

B. Material: 22 gauge, 0.0299 inch.

C. Color: As indicated on drawings.

2.5 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Accessories: Provide integral gang and face operated opposed blade damper, 2 inch filter frame, plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, and 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver or 90 degree duct elbow.

2.6 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.7 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As indicated on the drawings.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.8 INTAKE AND RELIEF LOUVERS

A. Louver Manufacturers:

1. Greenheck .

2. Ruskin.

B. Quality Assurance:

1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performace and water penetration ratings.

C. Fabrication:

1. Frame:

a. Material: Extruded aluminum, Alloy 6063-T5.

b. Wall Thickness: 0.081 inch (2.1mm), nominal.

c. Depth: 6 inches.

d. Downspouts and caulking surfaces.

2. Blades:

a. Style: Drainable.

b. Material: Extruded aluminum, Alloy 6063-T5.

c. Wall Thickness: 0.081 inch (2.1mm), nominal.

d. Angle: 37 degrees.

e. Centers: 6 inches.

3. Bird Screen:

a. Material: Aluminum, 3/4 inch x 0.51 inch expaned, flattened.

b. Frame: Removeable, rewireable.

4. Gutters: Drain gutters in head frame at each blade.

5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.

6. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.

7. Sill: Steeply angles integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

8. Assembly: Factory assemble louver components.

D. Perforamce Data:

1. Design Load: Incorporate structural supports required to withstand wind load of 25 pounds per square foot (100 mph wind equivalent).

E. Accessories:

1. Blank-Off Panels: 0.063 inch extruded aluminum, 2 inch insulated core finish to match louver.

2. Insect Screen: Aluminum mech construction.

F. Factory Finish:

1. Baked Enamel Finish:

a. Color shall be as selected by architect.

b. Finish to be applied after a thourough cleaning and preparation of the metal surface.

c. Total dry film thickness: 1.2 mils.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

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SECTION 237413

PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged roof top unit.

B. Unit controls.

C. Roof mounting curb and base.

1.2 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC: Control components, time clocks.

B. Section 260583 - Wiring Connections: Installation and wiring of thermostats and other controls components; wiring from unit terminal strip to remote panel.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

E. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

D. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

E. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

B. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

C. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

D. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer shall provide at a minimum a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed.

C. Coordinate with district and CM on any additional warranty requirements.

PART 2 PRODUCTS

2.1 ROOFTOP AIR HANDLING UNIT (GEOTHERMAL HEAT PUMP)

A. MANUFACTURERS

1. AAON (Basis of Design): www.aaon.com

2. Daikin; www.daikinapplied.com

3. Trane Technologies, PLC: www.trane.com

B. GENERAL DESCRIPTION

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers,water-cooled condenser,reheat coil,exhaust fans,energy recovery wheels,and unit controls.

2. Unit shall be factory assembled and tested includingleak testing of the DX coils,and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.

3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

4. Unit components shall be labeled, includingrefrigeration system components andelectrical and controls components.

5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.

6. Installation, Operation, and Maintenance manual shall be supplied within the unit.

7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

C. CONSTRUCTION

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moistureaccumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRIStandard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpointof the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

6. Access to filters, dampers,cooling coils,reheat coil,energy recovery wheels,water-cooled condensers,and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.

9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

10. Unit shall be provided with horizontal discharge and horizontal return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

11. Unit shall include lifting lugs on the top of the unit.

12. Unit base shall be fabricated of 1 inch thick double wall, impact resistant, rigid polyurethane foam panels.

D. ELECTRICAL

1. Refer to Schedules for basis of design electrical requirements (volts, amps, etc.)

2. Unit shall have a 5kAIC SCCR.

3. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

4. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.

E. SUPPLY FANS

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.

3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. EXHAUST FANS

1. Exhaust dampers shall be sized for 100% relief.

2. Fans and motors shall be dynamically balanced.

3. Unit shall include factory provided motorized relief dampers. The dampers shall be field installed.

4. Unit shall include barometric relief dampers.

5. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

6. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.

7. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.

8. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

G. COOLING COILS

1. Evaporator Coils

a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

b. Coils shall have interlaced circuitry and shall be standard capacity.

c. Coils shall have interlaced circuitry and shall be 6 row high capacity.

d. Coils shall be hydrogen or helium leak tested.

e. Coils shall be furnished with factory installed expansion valves.

2. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity, and unit shall include a two-stage compressor on the lag refrigeration circuit that shall modulate between two capacity settings, 67% and 100%.

3. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal whichallow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

4. Lag refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal whichallow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

5. Unit shall be configured as a water-source heat pump. Each refrigeration circuit shall be equipped with a factory installed liquid line filter drier with check valve, reversing valve,and expansion valves on both the indoor coil and refrigerant-to-water heat exchanger. Reversing valve shall energize during the heat pump cooling mode of operation.

6. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling. The controls shall also include an adjustable, 20 second delay timer for each additional capacity stage to prevent multiple capacity stages from starting simultaneouslyand adjustable compressor lock out.

7. Reheat Coil shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.

H. WATER-COOLED CONDENSER

1.

2. All field installed piping shall be hydrostatically tested before being put into service. Test pressure shall be 125 psi for a 2 hour duration.Leaks and loss in test pressure constitute defects. If test fails, corrections shall be made to the system and the test shall then be repeated to make certain all defects were corrected. All testing shall be performed to ASTM Standards.

3. Each heat exchanger circuit shall have a factory installed ball valve for water balancing

4. Each heat exchanger circuit shall have a flow switch that shuts down the compressors if water flow to the condenser is interrupted

5. Unit shall include factory installed head pressure control module and each heat exchanger shall include factory installed head pressure controlvalve which modulates the condenser water flow based on head pressure and allows cooling operation below 65°F condenser water temperature.

I. PREHEAT

1. Unit shall include an electric heater consisting of electric heating coils, fuses, and a high temperature limit switch.

2. Electric heating coils shall be located in the outside air preheat position.

3. Electric heater shall have modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A preheat enable signal shall be required from the unit controller.

J. FILTERS

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.

2. Unit shall include 4 inch thick, pleated panel filters with an ASHRAEMERV rating of 13, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4 inch standard filters.

3. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.

4. Unit shall include a clogged filter switch.

K. OUTSIDE AIR/ECNOMIZER

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals.Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper.Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring returnenthalpy activated fully modulatingactuator. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.

L. ENERGY RECOVERY

1. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.Frame shall slide out for service and removal from the cabinet.

2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

3. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in thecassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangersand AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

4. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date oforiginal equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to allparts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchangewritten instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

5. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.

6. Hinged service access doors shall allow access to the wheel.

7. Unit shall include energy recovery wheel defrost control which includes an adjustable temperature sensor and timer wired to periodically stop the wheel rotation, which allows the warm exhaust air to defrost the wheel.

8. Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contracts for field indication of wheel rotation.

9. Aluminum Energy Recovery Wheels

   a. Unit shall contain a factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a durable segmented link drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.

   b. Aluminum Energy recovery wheel shall be covered under the standard AAON limited parts warranty; the first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts.

   c. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coated segments shall be cleanable with hot water or compressed air without degrading the latent recovery.

M. ACCESSORIES

1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

2.2 CONTROLS

A. Factory Installed and Factory Provided Controller

B. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

C. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

D. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

E. Variable Air Volume Controller (RTU-156, RTU-136)

1. Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy.Supply fan speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.

2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.

F. Makeup Air Controller (RTU-DOAS-100)

1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.

2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.

G. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or withconnection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, andoccupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

2.3 CURBS

A. (RTU-DOAS-100, RTU-136) Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit.Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

B. (RTU=156) Curb shall be an insulated plenum roof curb with side return and supply. Provide with 1" insulated floor [return plenum] and 1" duct collar connection. Equivalent to Thybar.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Installation, Operation, and Maintenance manual shall be supplied with the unit.

3.3 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

B. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

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SECTION 237433
DEDICATED OUTDOOR AIR UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outdoor-mounted DOAS.

B. Direct fired make-up air heater.

1.2 RELATED REQUIREMENTS

A. Section 230513 - Common Motor Requirements for HVAC Equipment.

B. Section 230934 - Variable-Frequency Motor Controllers.

C. Section 231123 - Natural-Gas Piping: Natural gas connections.

D. Section 233300 - Air Duct Accessories: Flexible duct connections.

E. Section 251400 - Integrated Automation Local Control Units.

F. Section 253500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

G. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015, with Addendum (2016).

C. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 54 - National Fuel Gas Code; 2021.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Filters: One set of each type and size.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturers warranty for compressor/condenser unit.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CaptiveAire Systems; _____: www.captiveaire.com.

B. Greenheck; Basis of Design: www.greenheck.com.

2.2 OUTDOOR-MOUNTED MAKE-UP AIR UNIT (MAU-100)

A. Packaged Unit:

1. Units with Integral Heating shall be fully assembled at the the factory and consist of an insulated metal cabinet, a curb assmembly, an outdoor air intake weatherhood with bird screen, a motorized intake damper, supply air blower assembly, electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

2. Casing and Components:

a. Fabrication: AHRI 210/240 and UL 207 construction, ASHRAE Std 23 tested.

b. 18 gauge, 0.0478 inch steel panels reinforced with structural angles and channels to ensure rigidity.

c. Provide bolted access panels to access each sections from either side of unit.

d. Provide hinged door with lockable handle for serviceable sections.

e. Drain Pan: Galvanized steel with corrosion-resistant coating.

3. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.

4. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.

5. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.

6. External Surface Finish: Heat resistant baked enamel.

7. Outdoor Installation: Weatherproofed casing, with intake louver or hood.

8. Outside Air Damper with Rain Hood and Screen:

B. Filter Section:

1. Unit shall have 2" thick MERV 8 disposable pleated filters following the outdoor air intake in a V-bank arrangement and shall be accessible from the exterior of the unit.

C. Heating Section:

1. Direct Gas-Fired Furnace

a. Unit shall be factory assembled, piped, and wired. Direct gas-fired system will be 92% efficient while supplying a burner that is capable of providing 25:1 turndown. Unit will utilize a draw through design and incorporate adjustable burner baffles plates for field adjustments. Unit will have a EconomyPilot ignition system.

b. Burner construction shall consist of a cast aluminum burner manifold and 400 series stainless steel mixing plates. No air from inside the space shall be allowed to pass across the burner at any time. Flame sensing shall be provided by a flame rod. Burner control shall have a digital coded fault indicator capable of storing the last five faults.

c. Shall be equipped for operation on Natural gas with a maximum rated inlet gas pressure of 1/2 PSI.

d. Burner control option to include the following: Discharge temperature.

e. Shall include the following safety controls:

1) Manual Reset, High Limit Switch: Main gas valve closes if high-limit temperature is exceeded.

2) Dual safety shutoff valves shall be provided that do not exceed 120 VAC control signals.

3) FM Global Requirements: Includes high and low gas pressure switches and visual indication gas valves.

D. Fan Section:

1. Provide direct or plenum mounted variable-speed fan motors; see Section 230513.

2. Factory program for both soft start and constant flow output over static pressure range.

3. Provide preinstalled neutral wire protection when required to support specified fan type.

4. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.

5. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units; see Section 230934.

6. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.

7. Fan: Airfoil plenum fan statically and dynamically balanced, AMCA certified for air and sound performance.

8. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. Unit Controls:

1. DDC:

a. Refer to controls drawings and coordinate all required controls with Manufacturer, Temperature Controls Contractor, and Food Service Equipment Consultant.

b. Application Specific Controller; see Section 251400 unless factory-provided.

c. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.

d. Coordination and Sequencing:

1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.

2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, internal and remote contacts, and other devices required for operation.

3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, refrigerant freeze protection, and freezestat.

F. Furnish dedicated outdoor air unit and associated components and accessories produced by a single manufacturer.

G. Curb

1. A curb assembly shall be made of galvanized steel provided by the factory for field assembly and installation as part of this division. The curb shall include a duct adapter for supply air. The installing contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Follow NFPA 54 guidelines to provide natural gas system connection; see Section 231123.

C. Adjusting: Use plenum static pressure readings against manufacturer calibration chart to adjust primary airflow as other measuring methods will not work.

D. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote _____.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.3 START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.4 DEMONSTATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire Make-Up Air unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

3.5 MAINTENANCE

A. Provide service and maintenance of units for one year from Date of Substantial Completion.

SECTION 238126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor air handling (fan and coil) units for ductless systems.

C. Controls.

1.2 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Errata (2023).

D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.

2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

C. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 260583.

2.2 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Wall-mounted, self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.

1. Location: High-Wall

2. Controls: provide with wired wall mount thermostat.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.

1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2. Manufacturers: System manufacturer.

2.3 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).

1. Provide thermostatic expansion valves.

D. Operating Controls:

1. Control by room thermostat to maintain room temperature setting.

2. BACnet monitoring/control via controller in outdoor unit.

3. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

E. Mounting: 18" rooftop equipment support stand.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from cooling coils to nearest floor drain.

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SECTION 238149
GROUND-SOURCE UNITARY HEAT PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal/vertical GSHP.

1.2 RELATED REQUIREMENTS

A. Section 223000 - Plumbing Equipment: Domestic water heater or storage tanks.

B. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 232113 - Hydronic Piping: Load-side piping.

D. Section 232114 - Hydronic Specialties: Valves, strainers, PT test plugs, and other fittings.

E. Section 232123 - Hydronic Pumps.

F. Section 232500 - HVAC Water Treatment.

G. Section 233100 - HVAC Ducts and Casings.

H. Section 233300 - Air Duct Accessories.

I. Section 260583 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. ARI/ASHRAE/ISO Standard 13256-3 - Ground-Loop Heat Pump

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

G. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for each product furnished, including:

1. Electrical and performance data showing compliance with specifications.

2. Required water flow rates and temperatures for inflow and outflow.

3. Detailed electrical wiring diagrams.

4. Storage and handling requirements and recommendations.

5. Installation instructions.

6. Start-up, troubleshooting, and TAB instructions.

7. Specimen warranty.

C. Shop Drawings: Indicate piping connections and interface to supply and return ductwork, source-side water piping to buried loop, circulator pumps, and condensate drains. Include control wiring diagrams prepared specifically for this project including unit controls interface.

D. Operation and Maintenance Data: Include replaceable parts lists, parts sources, and troubleshooting guide.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Verify upon delivery that equipment nameplate data, including electrical data, matches specified and ordered equipment. Verify that refrigerant charge has been retained during shipping.

B. Handle water source heat pumps and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged water source heat pumps or components; repair per factory guidelines or replace with new.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store water source heat pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

E. Comply with manufacturer's rigging and installation instructions for unloading water source heat pumps and moving units to final location for installation

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only and does not include labor for removal and reinstallation.

C. Standard Warranty Period: All Parts: 1 year from startup or 18 months from ship date

D. Coordinate with Owner and Construction Manager on addtional warranty requirements.

PART 2 PRODUCTS

2.1 GROUND SOURCE HEAT PUMPS

A. Manufacturers

1. WaterFurnace International (Basis of Design)

2. Climate Master

3. Bosch/Florida Heat Pump

4. Daikin

B. General Requirements/Description

1. Factory assembled and tested, single packaged water-source heat pump consisting of a heavy gauge, galvanized steel cabinet with powder coat paint, sealed refrigerant circuit including a compressor, coaxial refrigerant to water heat exchanger, refrigerant to air heat exchanger, bi-directional thermal expansion valve, reversing valve, and reverse cycle refrigeration controls. The unit and all refrigeration components shall be rated for use with R-410A refrigerant. Field conversion of refrigerants will not be allowed.

C. Cabinet Construction:

1. Heavy gauge G-60 galvanized steel cabinet with a corrosion-resistant powder coating.

2. The interior shall be insulated with ½” thick, multi-density, aluminum foil coated glass fiber with edges sealed or tucked under flanges to prevent the introduction of glass fibers into the discharge air.

3. An insulated divider panel shall separate the fan section from the compressor compartment.

4. Removable service panels shall be provided to permit access to the compressor compartment, control box and fan section.

5. The cabinet shall have separate knockouts for the entrance of line voltage and low voltage control wiring.

D. Heat Exchanger:

1. Multiple row copper tube with enhanced aluminum fin heat exchanger design capable of withstanding 650 psig working pressure.

2. The condensate drain pan shall be constructed of high density polyethylene to inhibit corrosion and bacterial growth. optional secondary drain connection.

3. Hot Gas Reheat (Refer to Schedule for units requiring reheat)

   a. The internal reheat system shall be factory installed and include a high efficiency reheat coil located downstream of the evaporator coil, a reclaim valve and integral controls to allow heating, cooling and reheat/dehumidification modes

E. Compressor:

1. Provide hermetic, high efficiency, scroll or rotary type compressor installed on neoprene isolators and double isolated using an acoustically treated mounting bracket. A factory installed sound attenuating treatment shall be applied to the compressor. Provide high and low temperature cutouts, and compressor motor overload protection. Provide capability to reset compressor lockout circuit at either remote thermostat or circuit breaker.

F. Fan/Blower

1. The unit shall have a direct drive fan assembly with a dynamically balanced blower wheel.

2. Units with ECM Motor (Refer to Schedule)

   a. Provide a permanently lubricated ECM type motor, with internal overload protection. The variable speed ECM motor shall have multiple fan settings to deliver a constant air volume independent of changes in the systems static pressure.

3. Units with PC Motor (Refer to Schedule)

   a. Provide a permanently lubricated PSC motor, with internal overload protection and multi-speed taps.

G. Refrigeration Components:

1. Provide 4-way, electro-magnetically activated solenoid refrigerant reversing valve designed for fail-safe operation in the heating position. The solenoid coil assembly must be detachable from valve body. Provide a bi- directional, thermostatic expansion valve to deliver proper superheat over the complete range of operating water temperatures. Provide a liquid line filter dryer within the refrigerant circuit to maintain system integrity.

H. Water Piping Connections:

1. The unit shall have standard female NPT connections flush mounted to the cabinet exterior and shall incorporate an integral back-plate to secure the fitting without the need of a back-up wrench.

2. Provide 2-way water valve w/ water flow regulator.

3. Provide hose kit with memory stop.

I. Air Filters:

1. Provide a factory mounted deluxe filter rack. Field switchable for 1 in. or 2 in. filters.

2. 2” MERV 13 pleated fiberglass with filter rail.

J. Controls:

1. Coordinate all controls with Temperature Controls Contractor

2. Provide factory-mounted and factory-wired controls for sequenced operation of compressor, blower, reversing valve and system accessories. A 24-volt, minimum 75VA transformer with integral circuit breaker shall provide power to the low voltage controls. Provide safety lockout control with refrigerant high-pressure switch, refrigerant low-pressure or loss of charge switch, and water freeze protection. The lockout circuit shall be capable of being reset by either resetting the low voltage power supply or the main unit circuit breaker.

3. Provide an Aurora microprocessor-based controller that interfaces with a multi-stage electronic thermostat to monitor and control unit operation shall be provided. The control shall provide operational sequencing, blower speed control, high and low pressure switch monitoring, freeze detection, condensate overflow sensing, lockout mode control, LED status and fault Indicators, fault memory, field selectable options and accessory output. The control shall provide fault retry three times before locking out to limit nuisance trips.

K. Electric Heater

1. Provide electric, duct mounted heater for supplemental heating. Heating coil shall be by same

2. Heater shall be controlled by the heat pump controller.

3. Provide separate factory mounted disconnect.

2.2 GENERAL UNITARY HEAT PUMP FABRICATION REQUIREMENTS

A. Energy Efficiency: ASHRAE Std 90.1 I-P EER and COP ratings, minimum.

B. Factory assemble internal components, safety controls, accessories, filters, piping, cable, and wires, then charge with R-410A refrigerant prior to testing.

C. Include marked terminal strip to interface field-mounted components, accessories, and thermostat.

D. Comply with UL 1995, place service and caution labels on unit.

E. Cabinet Assembly:

1. Construct of zinc-coated, heavy-gauge, galvanized steel with exposed edges rounded.

2. Finish: Factory apply electrostatic powder paint or baked enamel finish. Coordinate with Architect for specific color finish requirements of console units or other units installed within occupied spaces.

3. Provide access panels for inspection, cleaning, and servicing of refrigerant, controls, condensate drain pan, coil, and blower.

4. Furnish 1-inch or 3-inch duct flange on open-discharge selections.

5. Interior Insulation: Minimum 1/2 inch thick, dual-density, bonded glass fiber.

6. Provide flame spread of less than 25, and smoke developed classification of less than 50 in accordance with ASTM E84 and UL 723.

7. Sound and Noise Suppression:

a. Mechanical Rooms: 18 gauge, 0.05 inch, minimum.

b. Occupied Spaces: 16 gauge, 0.06 inch, minimum.

c. Compressor enclosure lined with 1/2 inch thick insulation.

d. Include vibration isolation between compressor and heat exchanger.

e. Include length-wise unit base stiffeners.

f. Foam gasket sealant around compressor and end panel perimeter.

F. Blower Section:

1. Draw-through, forward-curved fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.

2. Factory program for both soft start and constant flow output over static pressure range.

3. Provide preinstalled neutral-wire protection when required to support specified fan type.

4. Motor to include thermal overload protection, quick-disconnect plug, and permanently lubricated bearings.

5. Belt-Driven Motor Requirements: Provide adjustable blower-motor/sheave combination device based on indicated flow performance requirements.

6. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units.

7. Fan Turndown: Design control features to allow fan-speed reduction to adjustable 50 percent of its capacity when zone set point temperature is satisfied or when unit runs in fan-only mode.

G. Evaporator Section:

1. Internally finned, aluminum or copper tubes mechanically bonded to configured aluminum plate fin, corrosion-inhibitor coated as indicated.

2. Refrigerant Coil Distributor Assembly: Orifice style with round copper distributor tubes.

3. Thermostatic Expansion Valve: Factory select and install for wide control range.

4. Factory leak test to minimum 450 psi and pressure test to minimum 600 psi.

5. Tubes: Size tubes consistent with coil capacity. Fabricate suction header from rounded copper pipe.

6. Completely evacuate air and charge with proper column of refrigerant prior to shipment.

H. Compressor Section:

1. Provide rubber mounting devices located underneath compressor mounting base.

2. Safety Interlocked Devices:

a. Thermal overload protection.

b. High-pressure switch for protection against excessive discharge pressure.

c. Low-pressure safety for protection against loss of refrigerant charge.

I. Refrigerant Tubing Lines:

1. Tubing made of copper with service pressure ports on high- and low-pressure sides.

2. Free from contaminants and conditions such as drilling fragments, dirt, and oil.

3. Include drier, thermal expansion valve, and other related components.

4. Freeze Protection: 30 degrees F, thermistor based.

J. Refrigerant Load Control:

1. Hot-Gas Bypass: Provide to increase heat transfer efficiency at low temperatures.

2. Hot-Gas Reheat Coil:

a. Humidity Control: Upgrade thermostat to include humidity sensor tied to unit controller for integral dehumidification control.

b. Coil Assembly: Aluminum or copper tubes mechanically expanded into evenly spaced aluminum fins.

c. Coil Testing: Proof test at minimum of 1.5 times maximum operating pressure, then leak test at maximum operating pressure.

3. Hot-Water Generator:

a. Secondary coil or heat exchanger, reversing valve, and accessories.

b. Storage: See Section 223000 for domestic water heaters or storage tanks.

K. Water-to-Refrigerant Heat Exchanger:

1. Coaxial Type: Provide aluminum or copper tube and fins.

2. Brazed-Plate Type: Stainless steel, with bidirectional liquid line filter drier.

3. Insulate heat exchanger, water lines, and refrigerant suction lines for prevention of condensation at temperatures below 60 degrees F.

4. Provide rubber isolation to heat exchanging device for enhanced sound attenuation.

5. Freeze Protection: 35 degrees F by thermistor sensing.

6. Minimum Working Pressure: 400 psi waterside, 600 psi DX side.

7. End Connections: Copper NPT. Provide flow shut-off ball valves.

8. Accessories:

a. Strainer, PT test plug, and flow regulator.

b. Unit-controlled, return-waterside solenoid valve.

L. Waterside Economizer Section:

1. Thermostat-controlled, metered, prepiped return air coil with 3-way valve assembly tied and coordinated by unit controller.

2. Provide assembly factory installed or shipped loose for field installation as indicated.

3. Performance Requirements: As indicated on drawings.

4. Air-to-Water Hydronic Coil:

a. Aluminum or copper tubes and aluminum plate fin combination.

b. Accessible, cleanable, dual-sloped, noncorrosive drain pan.

c. Leak test at maximum operating pressure.

d. Factory proof test at minimum 1.5 times maximum operating pressure.

5. Modulating or position-adjusted control valve to engage and control coil at listed EWT.

M. Filter Section:

1. ASHRAE Std 52.2, minimum efficiency reported value or MERV listing.

2. Filter Box: Provide field-installed, return-duct-mounted filter housing with side access.

N. Electrical:

1. Provide factory-installed phase loss safety device for 3-phase units.

2. Configure unit for single-point connection, include terminal for field-installed components.

3. Include separate holes and knockouts with plastic ferrules for respective electrical and controls wiring.

O. Unit Controls:

1. DDC:

a. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.

b. Coordination and Sequencing:

1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.

2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, load-pump contact, source-pump contact, and other devices required for operation.

3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, refrigerant freeze protection, and freezestat.

2. Thermostat:

a. Field mounted and wired, tied into prewired control-interface terminals.

b. Smart Thermostat:

1) BAS or BMS linked programmable thermostat; see Section 251400.

c. Programmable Thermostat:

1) Electro-mechanical type with key or pushbutton operated display.

2) Programmable occupied/unoccupied weekly and holiday schedule.

d. Non-Programmable Thermostat:

1) Electro-mechanical type with key- or pushbutton-operated display.

2) User configurable precoded options aligned with equipment functions.

e. Thermostat: Single-gang-box-mounted platinum or thermistor.

1) Local Interface to Include:

(a) Filter maintenance indicating status.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that available power supply complies with equipment specifications.

B. Do not begin installation until installation specifics such as buried ground loop have been properly prepared and ready for connection. Even if this is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install equipment in accordance with manufacturer's written installation instructions.

B. Install units with adequate clearance from obstructions to allow for servicing and filter replacement.

C. Coordinate installation of units with work being performed by other trades or contractors

D. Unit Mounting:

1. Ground or Surface Mount: Include vibration-isolated support base; see Section 230548.

2. Above Finished Floor: Include hangers and supports; see Section 230529. Proivide rubber isolators for hanging of each heat pump.

3. Do not obstruct maintenance access to equipment by any type of piping, electrical conduit, or other utility.

E. Ductwork:

1. Provide duct lining on return ductwork

2. Provide flexible duct connections at supply and return duct collars.

3. Provide flexible pipe connections at supply and return piping connections.

F. Ground-Water Source:

1. Fit-in and install externally interconnected equipment, devices, and components such as pumps and heat exchanger as applicable to specific selections.

2. Flush and clean piping before placing in operation; take precautions to prevent introduction of debris into piping systems.

G. Start system and adjust controls and equipment so as to give satisfactory operation.

H. Adjust water temperature control system and place in operation so that water quantities circulated are as required.

3.4 FIELD QUALITY CONTROL

A. Upon completion and before final acceptance of work, test each system to demonstrate compliance with the contract requirements.

1. Adjust controls and balance systems prior to final acceptance of completed systems.

2. Test controls through every cycle of operation.

3. Test safety controls to demonstrate performance of required function.

4. Furnish water, electricity, instruments, connecting devices, and personnel for tests.

5. Clean equipment, piping, strainers, ducts, and filters.

6. Coordinate testing with testing of related piping, specified elsewhere.

7. Correct defects in work and repeat tests.

B. Operational Testing: After demonstration of satisfactory operation perform operational testing:

1. Test each item of equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with equipment manufacturer's recommendations.

2. Verify that each item of equipment operating parameters are within limits recommended by the manufacturer.

3. Manufacturer's Recommended Test: Conduct the manufacturer's recommended field testing; furnish a factory trained field representative authorized by and to represent the equipment manufacturer during the complete execution of the field testing.

C. Additional requirements for testing, adjusting, and balancing (TAB) of piping, equipment, and controls are specified in Section 230593.

D. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval; include:

1. Unit nameplate data, and actual voltage and ampere consumption.

2. Load-side supply and return water flow and temperatures, and measurement equipment.

3. Source-side supply and return water flow and temperatures, and measurement equipment.

4. Ambient air temperature at heat pump unit.

5. Date and name and signature of person testing and reporting.

3.5 DEMONSTRATION

A. Provide the services of a factory-authorized representative for one day to instruct the Owner's personnel as specified:

1. Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, trouble-shooting, servicing, and preventative maintenance.

2. Review data in the maintenance manuals specified in Section 1.6.

3. Schedule training with Owner, through Project Manager, with at least 7 days' advance notice

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 238200
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vertical unit ventilators (Ground Source Heat Pumps).

B. Electric unit heaters.

C. Electric cabinet unit heaters.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project procedural and administrative requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 230005 - Basic HVAC Requirements

D. Section 230716 - HVAC Equipment Insulation.

E. Section 230719 - HVAC Piping Insulation.

F. Section 232113 - Hydronic Piping.

G. Section 232300 - Refrigerant Piping.

H. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.

2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 WARRANTY

A. All warranties shall start at the date of Substantial Completion for the Entire Project. Refer to CM's project schedule as part of Bid Documents. Provide extended warranties as required to comply.

PART 2 PRODUCTS

2.1 VERTICAL UNIT VENTILATORS (WATER-SOURCE HEAT PUMP)

A. Manufacturers:

1. Airedale/Modine

2. Systemair/Changeair

B. Performance Data and Safety Requirements:

1. Unit capacities certified and tested in accordance with AHRI 840 and AHRI 350.

2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Required Directory Listings: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

D. General

1. Furnish and install a self-contained vertical floor standing air conditioning unit ventilator, Water Source Heat Pump . Constructed in accordance with UL and CSA standards with a label affixed to the unit listing the product code under which it is registered. Unit performance shall be rated in accordance with AHRI 390. Unit shall be constructed following ISO: 9001 quality control program procedures and be fully assembled, charged, wired, and tested prior to shipment.

E. Cabinet

1. Insulation: 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials. 1-inch thick, acoustic Hushcloth Melamine with barrier and 2" acoustic Hushcloth Melamine with density of 0.56 pounds per cubic foot.

   a. Fire-Hazard Classification: Insulation shall have a fire rating of UL94HF-1.

   b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

2. Cabinet Construction: Constructed from aluminized steel with 20 gauge panels, degreased and coated with electrostatically applied baked-on polyester powder paint, except back panel will remain unpainted.

3. STUDY Acoustic Package: Unit to be constructed with multi-layered premium foam insulation with barrier, and revised airflow paths to maximize acoustic dampening.

4. Cabinet Interior: Interior right and left hand sides shall employ 20 gauge galvanized steel full double wall construction.

5. Cabinet Finish: The unit color shall be light grey. Paint finish shall be easily cleanable and hard wearing to give maximum protection. Paint finish sample to be sent and approved by architect prior to order.

6. Service and Maintenance Access: All service and maintenance access shall be possible through the front of the unit only.

7. Return air openings shall be integrated into the cabinet sides.

8. Access door is factory installed on the front of the unit. Door interior shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty ¼” zinc plated steel plunger hinges with a spring-loaded ¼” zinc plated steel pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.

9. Condensate Connection: Factory installed condensate connection stub provided for connection to the field installed building condensate drain. Tube dimensions 3/4" ID, 1" OD.

F. Heat Pump System

1. Compressor: Two stage hermetic scroll compressor mounted on four (4) 125# all neoprene rubber 35-45 durometer vibration isolators for quiet operation. Compressor contains an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased.

   a. An internal overload protector included to protect compressor against excessive motor temperatures and currents.

2. Compressor Acoustic Wrap with Base: For improved sound attenuation, compressor casing consists of 18oz PVC barrier laminated to 1/2 inch non-woven polyester. Casing includes integral 4 inch foil backed fiberglass heat shield for use with crankcase heater. Compressor base consists of 2 pound EVA barrier with embedded ¼ inch layered closed cell foam. Cover is easily removable for service.

3. Refrigeration Circuit (Cooling Only): Refrigeration system utilizes HFC-R410A and contains a factory fitted thermal expansion device and filter drier. Fitted with factory set automatic reset high-pressure and low-pressure cut-out switches and a sight glass included for system observation.

4. Indoor Coil: Patented micro-channel CFTM evaporator coil designed for maximum heat transfer with minimum footprint and pressure drop. Quick draining evaporator coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

5. Outdoor Coil (where applicable): Enhanced, high efficiency, cross rifled coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit.

G. Fans and Motors

1. The indoor fan assembly consists of one blower inside teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high efficiency and low audible noise. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

H. Economizer

1. Single-blade damper that pivots using a central single shaft attached to a single actuator allowing for complete balance of the return, outside, and exhaust air streams. Capable of full modulation allowing any mixture of outside air and return air to be possible. Will allow for 100% of the units airflow to be taken from the outside during conditions allowing for full economizer savings. Damper blade edges lined with rubber gasket to prevent air infiltration in full recirculation or full economizer operation. Complete damper assembly slides out of unit on rails allowing for the damper assembly to be removed through the front of the unit if it requires service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

2. Damper Actuator: Low voltage modulating damper actuator with spring-return, fail safe. When power is cut to actuator, damper actuator will force damper blade closed to outside air.

I. Hot Gas Reheat (packaged DX units)

1. Unit is equipped with a reclaim valve and a second condenser coil (reheat coil). When the unit enters the dehumidification mode, the unit will direct refrigerant to reheat coil to maintain space dry bulb temperature. When unit exits dehumidification mode, valve will reclaim refrigerant in reheat coil back to the system.

J. Filter

1. Filter: 2” thick and utilize 17.5 pleats per foot. Filter shall be constructed from 100% Synthetic media and be LEED/Green compliant. Minimum Efficiency Reporting Value of MERV 13 per ASHRAE standard 52.2. 99% Arrestance and 70-80% Dust Spot Efficiency based on the ASHRAE 52.1 - 1992 test method.

K. Control Panel

1. Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.

2. Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.

3. Plug and Socket Wiring: Supply and Exhaust Fan decks, compressor, damper assembly, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

L. Energy Recovery Ventilator with Economizer Dampers (where noted on schedule)

1. Energy recovery ventilation (ERV) provided within the unit through an enthalpy transfer wheel mounted in an insulated cassette frame complete with seals, drive motor, and belt. The rotary wheel is coated with silica gel desiccant and is sized to handle a maximum of 500 cfm of outside air. The entire assembly shall be a UL tested component. Performance shall be certified in accordance with the ASHRAE Standard 84 method of test and AHRI Rating Standard of 1060.

2. ERV Fans: ERV section employs dual electronically commutated ventilation fans to ensure precise control of airflow through energy wheel and provide optimal wheel frost protection as required.

3. Outside Air Damper: Separate outside air damper and actuator provided for protection from outdoor elements when unit is not in use.

4. Complete energy recovery ventilator installed on rails to allow the entire assembly to be slid out of the unit for service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

5. Full Economizer Mode: Includes the addition of an economizer damper with actuator and return air damper with actuator. This option enables full economizer functionality by closing off return air allowing up to 100% volume of outside air during free cooling applications.

6. ERV Defrost Cycle: During occupied mode, if the outdoor air temperature falls below 15°F, the microprocessor controller will close the outdoor air damper and de-energize outside air ventilation fan while the wheel and exhaust air ventilation fan continue to run to properly defrost wheel.

M. Controls

1. Packaged Controls by Manufacturer. Refer to controls drawings.

N. Factory Installed Options

1. Disconnect Switch: A power disconnect switch sized for the full load amperage of the unit. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

2. Electric Reheat Coil: Provide with optional electric heater. where indicated on dawings.

3. Needlepoint Bipolar Ionization (NPBI): Mounted to the supply fan blower housing, NPBI introduces ions into the space to purify the air by eliminating airborne particulates, odors, and pathogens. When ions are introduced to the space, particles are clustered together and captured by the unit's filter. The device shall operate between -20°F and 200°F, and 0-100% relative humidity. The device is UL, cUL, and CE listed, UL 867 and UL 2998 certified, and maintenance free (self-cleaning).

O. Field Installed Accessories

1. Outside Air Rear Extension (where applicable): Where site conditions do not permit the use of the standard locations for outside air intake and exhaust air discharge, an insulated outside air rear extension is supplied for site installation between the back of the unit and the outside wall by the mechanical contractor. The outside air rear extension is 6" deep and with adjustable panels to allow for the exhaust air discharge to be at a height from floor of 30"- 38".

2. Wall Sleeve (where applicable): Designed to provide a sealed plenum for the fresh air intake and exhaust air outlet on the back of the classroom unit to the outside of the building. Intake and exhaust airstreams are separated with an insulated horizontal splitter plate. A two-piece frame allows for the sleeve to adjust to wall depths between 8” and 14”. Includes double-sided gasket to create an air tight seal between the wall sleeves and the back of the unit.

3. Louver (where applicable): An outdoor louver suitable for masonry, glass, or panel wall construction. The louvers are flanged style with the following:

   a. Aluminum with bird screen and a clear 2-Coat AAMA 2605 Kynar finish - Greenheck ESU154 Model

4. Supply Air Replacement Filters: The unit shall be provided with set(s) of MERV 13 supply air replacement filters (Qty of 2).

2.2 ELECTRIC UNIT HEATERS

A. Manufacturers:

1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.

2. Modine Manufacturing Company: www.modineHVAC.com.

3. Trane, a brand of Ingersoll Rand: www.trane.com.

4. Markel: www.markel-products.com

5. Substitutions: See Section 016000 - Product Requirements.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.

D. Acceptable Heating Element Assemblies:

1. Horizontal Projection Units:

   a. Steel fins copper brazed to steel sheath and epoxy sealed for moisture resistance.

E. Housing:

1. Horizontal Projection Units:

a. Construction materials to consist of heavy gage steel with polyester powder coat finish.

b. Provide with threaded holes for threaded rod suspension.

c. Provisions for access to internal components for maintenance, adjustments, and repair.

F. Air Inlets and Outlets:

1. Inlets: Provide stamped louvers.

2. Outlets: Provide directional louvers.

G. Fan: Factory balanced, direct drive, axial type with fan guard.

H. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

I. Controls (refer to floor plans for remote thermostats, otherwise built-in thermostat):

1. Terminal block for remote control.

2. Fan speed switch.

3. Built-in thermostat.

2.3 ELECTRIC CABINET UNIT HEATERS

A. Manufacturers:

1. Markel: www.markel-products.com

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Heating Elements: Provide finned tubular.

D. Cabinet: Minimum 18 gage, 0.0478 inch thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.

E. Finish:

1. Factory applied, painted finish.

2. Color: As selected from color chart.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Controls (refer to floor plans for remote thermostats, otherwise built-in thermostat):

1. Control transformer.

2. Control relays.

3. Thermal cutout with automatic reset to de-energize electric heating elements in the event of overheating.

4. Fan speed switch.

5. Thermostat.

I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are suitable for installation.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

D. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

E. Do not damage equipment or finishes.

F. Unit Heaters:

1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.

2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

G. Cabinet Unit Heaters:

1. Install as indicated.

2. Coordinate to ensure correct recess size for recessed units.

H. Unit Ventilators:

1. Locate as indicated, level and shim units, and anchor to structure.

2. Coordinate exact location of wall louvers.

I. Units with Cooling Coils: Connect drain pan to condensate drain.

3.3 FIELD QUALITY CONTROL

A. Refer to Division 01 - General Requirements for additional requirements.

B. Provide manufacturer's field representative to test, inspect, instruct, and observe.

3.4 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

3.5 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

3.6 SYSTEM START UP

A. Start-up units in accordance with manufacturer’s start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

SECTION 260005
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. This section applies to all sections of Division 26 and Division 28.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

1.2 DRAWINGS

A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

1.3 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.4 TEMPORARY FACILITIES

A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

1.5 ALTERNATES AND SUBSTITUTIONS

A. Refer to Division 01 - General Requirements for procedures.

1.6 GUARANTEE

A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.7 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.8 STANDARDS OF MATERIAL AND WORKMANSHIP:

A. All materials shall be new, unless noted otherwise. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable standard specifications of the following recognized authorities:

1. A.N.S.I. - American National Standards Institute

2. A.S.T.M. - American Society for Testing Materials

3. I.C.E.A. - Insulated Cable Engineers Association

4. I.E.E.E. - Institute of Electrical and Electronics Engineers

5. N.E.C. - National Electrical Code (NFPA 70)

6. N.E.C.A. - National Electrical Contractors Association

7. N.E.M.A. - National Electrical Manufacturer's Association

8. N.F.P.A. - National Fire Protection Association

9. U.L. - Underwriters Laboratories, Inc.

B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.

C. All equipment of the same or similar systems shall be by the same manufacturer.

1.9 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:

1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.

2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.10 SUBMITTALS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (light fixtures, wiring devices, etc.). Refer to other sections of the electrical specifications for additional requirements.

C. Engineer WILL NOT REVIEW:

1. Submittals not specified.

2. Submittals which do not indicate optional equipment being provided.

3. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.

4. Submittals made after work is delivered to site and/or installed.

5. Submittal resubmissions unless resubmission is required by Architect/Engineer.

1.11 MANUFACTURERS LISTED

A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer five (5) days prior to bid date.

1.12 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

B. Do not use Owner's light fixtures for temporary lighting except as allowed and directed by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.

B. Equipment location shall be as close as practical to locations shown on the drawings.

C. Working clearances shall not be less than specified in NFPA 70 (National Electric Code).

3.2 COORDINATION

A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at Contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

3.3 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.

B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.4 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.

B. Where conduit is installed less than 30" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.

C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

3.5 EQUIPMENT FOUNDATION AND SUPPORTS

A. Shall be as required or as shown on plans or specified.

B. Provide concrete house keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment. Coordinate requirements with Division 03 - Concrete.

C. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

3.6 EQUIPMENT CONNECTIONS

A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

3.7 ACCESS DOORS AND PANELS

A. Refer to Division 08 - Openings; Provide access doors in locations as required per N.E.C. Coordinate locations with architectural trades.

3.8 CLEANING

A. Refer to Division 01 - General Requirements; All equipment shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.9 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

3.10 DRAWINGS AND MEASUREMENTS

A. Electrical drawings are not intended to be scaled for rough-in measurements nor to serve as submittals. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor.

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Mineral-Insultated cable.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Oxide inhibiting compound.

H. Wire pulling lubricant.

I. Cable ties.

J. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 07 - Thermal and Moisture Protection: Firestopping.

D. Section 260005 - Basic Electrical Requirements.

E. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

F. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

G. Section 260536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.

H. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 263100 - Photovoltaic Collectors: Additional wiring requirements for photovoltaic systems.

J. Section 284600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

K. Division 31 - Earthwork: Excavating, bedding, and backfilling.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

K. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

L. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

M. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

N. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

O. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

1) Maximum Length: 6 feet.

b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

H. Mineral-Insulated cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For feeders from Generator to Fire Pump.

I. Manufactured wiring systems are not permitted.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.

d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

a. Cerro Wire LLC: www.cerrowire.com.

b. Encore Wire Corporation: www.encorewire.com.

c. General Cable Technologies Corporation: www.generalcable.com.

d. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Stranded.

b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com.

2. Encore Wire Corporation: www.encorewire.com.

3. Southwire Company: www.southwire.com.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Stranded.

2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

9. Provide oversized neutral/grounded conductors where indicated and as specified below.

a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.

b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):

a. Use listed fittings.

b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

C. Section 260005 - Basic Electrical Requirements

D. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

E. Section 260536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 263100 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.

H. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

I. Division 31 - Earthwork: Excavating, trenching and fill.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.

2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.

3. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Project Record Documents: Record actual locations of grounding electrode system components and connections.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

   a. Provide continuous grounding electrode conductors without splice or joint.

   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):

   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.

   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Concrete-Encased Electrode:

   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

4. Ground Ring:

   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.

   b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.

   c. Provide ground enhancement material around conductor.

   d. Provide connection from ground ring conductor to:

1) Perimeter columns of metal building frame.

2) Ground rod electrodes located as indicated.

5. Ground Rod Electrode(s):

a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.

b. Space electrodes not less than 10 feet from each other and any other ground electrode.

c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.

c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

G. Cable Tray Systems: Also comply with Section 260536.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

4. Manufacturers - Mechanical and Compression Connectors:

a. Advanced Lightning Technology (ALT): www.altfab.com

b. Burndy LLC: www.burndy.com

c. Harger Lightning & Grounding: www.harger.com

d. nVent ERICO; _____: www.nvent.com/

e. Thomas & Betts Corporation: www.tnb.com

5. Manufacturers - Exothermic Welded Connections:

a. Burndy LLC: www.burndy.com

b. nVent ERICO; Cadweld: www.nvent.com

c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

4. Manufacturers:

a. Advanced Lightning Technology (ALT): www.altfab.com

b. Harger Lightning & Grounding: www.harger.com

c. nVent ERICO: www.nvent.com/

d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.

3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.

5. Manufacturers:

a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.

b. Galvan Industries, Inc: www.galvanelectrical.com/#sle.

c. Harger Lightning & Grounding: www.harger.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

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SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, and cutting and patching requirements.

C. Division 03 - Concrete: Concrete equipment pads.

D. Section 260005 - Basic Electrical Requirements

E. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

F. Section 260536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

G. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

H. Section 262513 - Low-Voltage Busways: Additional support and attachment requirements for busway.

I. Section 263100 - Photovoltaic Collectors: Photovoltaic module mounting systems.

J. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

K. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.

2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.

a. NFPA 70.

b. Requirements of authorities having jurisdiction.

2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.

4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use products for applications other than as permitted by NFPA 70 and product listing.

6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.

   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

1. Manufacturers:

   a. ABB: www.electrification.us.abb.com

   b. Eaton Corporation: www.eaton.com

   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com

   d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com

   e. nVent; Caddy: www.nvent.com

D. Metal Channel/Strut Framing Systems:

1. Manufacturers:

   a. ABB: www.electrification.us.abb.com/#sle.

   b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.

   c. Eaton Corporation: www.eaton.com/#sle.

2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

3. Comply with MFMA-4.

4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

a. Equipment Supports: 1/2-inch diameter.

b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.

c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.

d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.

e. Outlet Boxes: 1/4-inch diameter.

f. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:

a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.

b. Eaton Corporation: www.eaton.com/#sle.

c. nVent; Caddy: www.nvent.com/#sle.

d. PHP Systems/Design: www.phpsd.com/#sle.

2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.

3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:

a. Dewalt: anchors.dewalt.com

b. Hilti, Inc: www.hilti.com

c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com

d. Simpson Strong-Tie Company Inc: www.strongtie.com

2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.

5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Cable Tray Support and Attachment: See Section 260536 for additional requirements.

J. Box Support and Attachment: See Section 260533.16 for additional requirements.

K. Busway Support and Attachment: See Section 262513 for additional requirements.

L. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

M. Exterior Luminaire Support and Attachment: See Section 265600 for additional requirements.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. Flexible metal conduit (FMC).

D. Galvanized steel electrical metallic tubing (EMT).

E. Aluminum electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 03 - Concrete: Concrete encasement of conduits.

D. Division 07 - Thermal and Moisture Protection: Firestopping.

E. Section 260005 - Basic Electrical Requirements

F. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

G. Section 260526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

H. Section 260529 - Hangers and Supports for Electrical Systems.

I. Section 260533.16 - Boxes for Electrical Systems.

J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

K. Section 284600 - Fire Detection and Alarm: Fire alarm wiring in conduit.

L. Division 31 - Earthwork: Excavating, trenching and fill.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

O. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

S. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

T. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.

2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.

3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.

4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.

5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, stainless steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.

6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

7. Where galvanized steel electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

8. Where aluminum rigid metal conduit (RMC) or aluminum electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

9. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.

2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

E. Concealed Within Masonry Walls: Use intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, aluminum rigid metal conduit, or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use stainless steel rigid metal conduit (RMC), aluminum rigid metal conduit (RMC), stainless steel intermediate metal conduit (IMC), or stainless steel electrical metallic tubing (EMT).

K. Exposed, Interior, Subject to Severe Physical Damage: Use stainless steel rigid metal conduit (RMC), aluminum rigid metal conduit (RMC), or stainless steel intermediate metal conduit (IMC).

L. Exposed, Exterior: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.

M. Exposed, Exterior, Subject to Severe Physical Damage: Use stainless steel rigid metal conduit (RMC) or stainless steel intermediate metal conduit (IMC).

N. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use intermediate metal conduit (IMC).

O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

P. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).

3. Vibrating equipment includes, but is not limited to:

a. Transformers.

b. Motors.

Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Provide conduit, fittings, supports, and accessories required for complete raceway system.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.

2. Flexible Connections to Luminaires: 3/8-inch trade size.

3. Underground, Interior: 1 inch (27 mm) trade size.

4. Underground, Exterior: 1-inch trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com

2. Republic Conduit: www.republic-conduit.com

3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.

2. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.

b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.

3. Material: Use aluminum.

4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com

2. Electri-Flex Company: www.electriflex.com

3. International Metal Hose: www.metalhose.com

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

2.6 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com

2. Republic Conduit: www.republic-conduit.com

3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.7 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.

2. Material: Use aluminum.

3. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. ABB; Carlon: www.carlon.com/#sle.

2. Cantex Inc: www.cantexinc.com

3. JM Eagle: www.jmeagle.com

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Foam Conduit Sealant:

1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.

2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

3. Rated to hold minimum of 10 ft water head pressure.

F. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.

2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.

3. Suitable for sealing around conductors/cables to be installed.

G. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

H. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.

2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

I. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.

2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal conduits unless specifically indicated to be exposed.

4. Conduits in the following areas may be exposed, unless otherwise indicated:

   a. Electrical rooms.

   b. Mechanical equipment rooms.

5. Unless otherwise approved, do not route exposed conduits:

   a. Across floors.

   b. Across roofs.

   c. Across top of parapet walls.

   d. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

7. Arrange conduit to maintain adequate headroom, clearances, and access.

8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.

9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

10. Group parallel conduits in same area on common rack.

G. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

4. Use conduit strap to support single surface-mounted conduit.

   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.

6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.

7. Use of wire for support of conduits is not permitted.

H. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

5. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.

6. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

7. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

J. Underground Installation:

1. Provide trenching and backfilling in accordance with Division 31.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Division 03 with minimum concrete cover of 2 inches on all sides unless otherwise indicated.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

3. Where conduits are subject to earth movement by settlement or frost.

M. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

a. Where conduits enter building from outside.

b. Where service conduits enter building from underground distribution system.

c. Where conduits enter building from underground.

d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.

b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide grounding and bonding; see Section 260526.

O. Identify conduits; see Section 260553.

3.3 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete.

C. Division 07 - Thermal and Moisture Protection: Firestopping.

D. Division 08 - Openings: Access Doors.

E. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

F. Section 260005 - Basic Electrical Requirements.

G. Section 260526 - Grounding and Bonding for Electrical Systems.

H. Section 260529 - Hangers and Supports for Electrical Systems.

I. Section 260533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.

2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

K. Section 262726 - Wiring Devices:

1. Wall plates.

2. Floor box service fittings.

L. Section 262813 - Fuses: Spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Keys for Lockable Enclosures: Two of each different key.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.

4. Use suitable masonry type boxes where flush-mounted in masonry walls.

5. Use raised covers suitable for the type of wall construction and device configuration where required.

6. Use shallow boxes where required by the type of wall construction.

7. Do not use "through-wall" boxes designed for access from both sides of wall.

8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

12. Wall Plates: Comply with Section 262726.

13. Manufacturers:

    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com

    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com

    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com

    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com

    e. Thomas & Betts Corporation: www.tnb.com

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. NEMA 250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:

a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:

a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.

b. Back Panels: Painted steel, removable.

c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

D. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.

2. Use cast iron floor boxes within slab on grade.

3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).

4. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 260526.

3.3 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

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SECTION 260536
CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal cable tray systems:

1. Metal solid-bottom cable tray.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 07 - Thermal and Moisture Protection: Firestopping.

C. Section 260005 - Basic Electrical Requirements

D. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260529 - Hangers and Supports for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA VE 1 - Metal Cable Tray Systems; 2017.

D. NEMA VE 2 - Cable Tray Installation Guidelines; 2018.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 568 - Nonmetallic Cable Tray Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.

2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

C. Sequencing:

1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Project Record Documents: Record actual routing of cable tray and locations of supports.

PART 2 PRODUCTS

2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.2 METAL CABLE TRAY SYSTEMS

A. Manufacturers:

1. Metal Cable Tray System:

a. Cablofil, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

b. Chalfant Manufacturing Company; _____: www.chalfant-obo.com/#sle.

c. Cope, a brand of Atkore International Inc; _____: www.copecabletray.com/#sle.

d. Thomas & Betts Corporation; _____: www.tnb.com/#sle.

2. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

B. Comply with NEMA VE 1.

C. Finishes:

1. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.

D. Metal Solid-Bottom Cable Tray:

1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.

2. Bottom Type: Solid corrugated or flat.

3. Load/Fill Depth: As indicated on drawings.

4. Span/Load Rating: As indicated on drawings.

5. Inside Width: As indicated on drawings.

6. Inside Radius of Fittings: 12 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify that field measurements are as indicated.

C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

F. Cable Tray Movement Provisions:

1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:

a. Where cable tray crosses structural joints intended for expansion.

b. Long straight cable tray runs in accordance with NEMA VE 2.

2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.

3. Set gaps for expansion fittings in accordance with NEMA VE 2.

G. Cable Provisions:

1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.

2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.

3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.

H. Provide end closures at unconnected ends of cable tray runs.

I. Cable Tray Support:

1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 260529, where not furnished by cable tray manufacturer.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

J. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:

1. Comply with grounding and bonding requirements of NEMA VE 2.

2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.

3. Metal cable tray system may be used as sole equipment grounding conductor only where all conditional requirements of NFPA 70 are met, including but not limited to:

a. Installation must be in a qualifying facility with suitable maintenance and supervision as determined by authorities having jurisdiction.

b. Cable tray system must be steel or aluminum (as specified) and classified as an equipment grounding conductor (note that stainless steel cable tray is not permitted for use as an equipment grounding conductor).

c. Cable tray must meet minimum cross-sectional area requirements.

K. Cable Installation:

1. Comply with cable installation requirements of NEMA VE 2.

2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.

3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.

a. Distance Between Fastening Points for Vertical Runs: 18 inches.

b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.

L. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 078400.

M. Identification Requirements, in Addition to Those Specified in Section 260553.

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SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 09 - Finishes: Interior and Exterior Painting.

C. Section 260005 - Basic Electrical Requirements

D. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

E. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

F. Section 260573 - Power System Studies: Arc flash hazard warning labels.

G. Section 262726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

H. Section 263100 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Transformers:

1) Identify kVA rating.

2) Identify voltage and phase for primary and secondary.

3) Identify power source and circuit number. Include location when not within sight of equipment.

d. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location when not within sight of equipment.

3) Identify load(s) served. Include location when not within sight of equipment.

e. Transfer Switches:

1) Identify voltage and phase.

2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:

a. Use identification nameplate to identify each service disconnecting means.

3. Emergency System Equipment:

a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.

b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

6. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.

a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.

7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

a. Service equipment.

b. Industrial control panels.

c. Motor control centers.

d. Elevator control panels.

e. Industrial machinery.

8. Arc Flash Hazard Warning Labels: Comply with Section 260573.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.

2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.

a. Maximum Intervals: 20 feet.

b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.

1) Field-Painting: Comply with Section 099123 and 099113.

2) Vinyl Color Coding Electrical Tape: Comply with Section 260519.

c. Color Code:

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

4. Use underground warning tape to identify underground raceways.

5. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Cable Tray: Comply with Section 260536.

F. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.

2. Use voltage markers or color coded boxes to identify systems other than normal power system.

a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.

G. Identification for Devices:

1. Wiring Device and Wallplate Finishes: Comply with Section 262726.

2. Use identification label to identify fire alarm system devices.

a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.

3. Use identification label to identify serving branch circuit for all receptacles.

a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

H. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:

a. Brimar Industries, Inc: www.brimar.com/#sle.

b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

c. Seton Identification Products: www.seton.com/#sle.

2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:

a. Brady Corporation: www.bradyid.com/#sle.

b. Brother International Corporation: www.brother-usa.com/#sle.

c. Panduit Corp: www.panduit.com/#sle.

2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 1/2 inch.

5. Color: Black text on yellow background unless otherwise indicated.

D. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Power source and circuit number or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background.

E. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Designation indicated and device zone or address.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.

3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.

2. Markers for System Identification:

a. Emergency Power System: Text "EMERGENCY".

E. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

1. Tape for Buried Power Lines: Black text on red background.

2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:

a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.

5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.

7. Conduits: Legible from the floor.

8. Boxes: Outside face of cover.

9. Conductors and Cables: Legible from the point of access.

10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

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SECTION 260573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 260005 - Basic Electrical Requirements.

C. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

D. Section 262413 - Switchboards.

E. Section 262416 - Panelboards.

F. Section 262813 - Fuses.

G. Section 262816.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 1 - Motors and Generators; 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.

2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.

2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Identify modifications made in accordance with studies that:

a. Can be made at no additional cost to Owner.

b. As submitted will involve a change to the contract sum.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of new electrical distribution system as indicated on drawings.

2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).

3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:

1. Comply with NFPA 70.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.

a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.

1) Obtain up-to-date information from Utility Company.

b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.

d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.

e. Protective Devices:

1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a. Maximum utility fault currents.

b. Maximum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.

2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a. Maximum and minimum utility fault currents.

b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Study Reports:

1. General Requirements:

a. Identify date of study and study preparer.

b. Identify study methodology and software product(s) used.

c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.

d. Identify base used for per unit values.

e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.

f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:

1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).

2) Fault point X/R ratio.

3) Associated equipment short circuit current ratings.

b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Arc Flash and Shock Risk Assessment:

a. For the worst case for each scenario, identify at each bus location:

1) Calculated incident energy and associated working distance.

2) Calculated arc flash boundary.

3) Bolted fault current.

4) Arcing fault current.

5) Clearing time.

6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 260553.

2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include the following information:

1) Arc flash boundary.

2) Available incident energy and corresponding working distance.

3) Nominal system voltage.

4) Equipment identification.

5) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.2 FIELD QUALITY CONTROL

A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.

SECTION 260935
DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System

B. Digital Load Controllers (Room and Fixture Controllers)

C. Digital Wall or Ceiling Mounted Occupancy Sensor

D. Digital Wall Switch Occupancy Sensors

E. Digital Wall Switches

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 260005 - Basic Electrical Requirements.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.13 - Conduit for Electrical Systems.

E. Section 260533.16 - Boxes for Electrical Systems.

F. Section 260553 - Identification for Electrical Systems.

G. Section 262726 - Wiring Devices.

H. Section 265100 - Interior Lighting.

I. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. FCC Article 15, Section J, Class A.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA WD 7 - Occupancy Motion Sensors Standard; Current Edition.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most recent edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.

F. UL 508 - Standard for Industrial Control Equipment; Current Edition, including all Revisions.

G. UL 916 - Standard for Energy Management Equipment; Current Edition, including all Revisions.

H. UL 924 - Standard for Emergency Lighting and Power Equipment

I. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital lighting control system shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Catalog sheets and specifications.

2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

3. Storage and handling requirements and recommendations.

4. Installation instructions.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:

1. Project Record Documents: Record actual installed locations and settings for lighting control devices.

2. Operation and Maintenance Manual:

a. Include approved Shop Drawings and Product Data.

b. Include Sequence of Operation, identifying operation for each room or space.

c. Include manufacturer's maintenance information.

d. Operation and Maintenance Data: Include detailed information on device programming and setup.

e. Include startup and test reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:

1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:

1. Record minutes of the conference and provide copies to all parties present.

2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.

3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).

2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Lutron

2. Wattstopper (Legrand)

3. nLight (Acuity Brands)

4. Crestron

5. Leviton

6. Enlighted (Siemens)

7. Engineer pre-approved equal.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide digital lighting control system complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing, this specification, contact the Engineer for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, classroom, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:

   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.

   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.

   c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.

   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

3. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system for power and data to room devices.

2. Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.

3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.

5. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

C. Local Network: Digital lighting control local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the digital lighting control local network include:

a. Automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

b. Simple replacement of any device in the local digital lighting control network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.

c. Ability to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2. Digital room devices connect to the local network using pre-terminated low voltage cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

3. If manufacturer's pre-terminated low voltage cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

4. Provide input from fire alarm system. Upon receipt of signal from fire alarm system the lighting control system shall override all lighting controls and provide full illumination to all emergency fixtures along the path of egress for a minimum of 90 minutes or until fire alarm system is reset.

2.3 DIGITAL LOAD CONTROLLERS (ROOM AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.

3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.

4. Device Status LEDs to indicate:

    a. Data transmission

    b. Device has power

    c. Status for each load

    d. Configuration status

5. Quick installation features including:

    a. Standard junction box mounting

    b. Quick low voltage connections using standard RJ-45 patch cable

6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

    a. Turn on to 100 percent

    b. Turn off

    c. Turn on to last level

7. Each load be configurable to operate in the following sequences based on occupancy:

    a. Auto-on/Auto-off (Follow on and off)

    b. Manual-on/Auto-off (Follow off only)

8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

9. BACnet object information shall be available for the following objects:

    a. Load status

    b. Schedule state, normal or after-hours

c. Demand Response enable and disable

d. Room occupancy status

e. Total room lighting and plug loads watts

f. Electrical current

g. Total watts per controller

h. Total room watts/sq ft.

i. Force on/off all loads

10. UL 2043 plenum rated

11. Manual override and LED indication for each load

12. Zero cross circuitry for each load

13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

14. Dimming Room Controllers shall share the following features:

    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

    c. The following dimming attributes may be changed or selected using a wireless configuration tool:

        1) Establish preset level for each load from 0-100 percent

        2) Set high and low trim for each load

        3) Initiate lamp burn in for each load of either 0, 12 or 100 hours

    d. Override button for each load provides the following functions:

        1) Press and release for on/off control

        2) Press and hold for dimming control

e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. Fixture Controllers shall include

1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.

2. One 3A 120/277V rated mechanically held relay.

3. Programmable behavior on power up following the loss of normal power:

a. Turn on to 100 percent

b. Turn off

c. Turn on to last level

4. Requirement for 7 mA of 24VDC operating power from the digital lighting control local network.

5. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the digital lighting control local network to drive accessory devices.

6. Power to drive the fixture controller electronics can come from any room controller

7. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.

8. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the digital lighting control local network.

9. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.

10. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:

a. Sensitivity, 0-100 percent in 10 percent increments

b. Time delay, 1-0 minutes in 1 minute increments

c. Test mode, Five second time delay

d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.

e. Walk-through mode

2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.

3. Programmable control functionality including:

a. Each sensor may be programmed to control specific loads within a local network.

b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.

c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.

d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

e. Ultrasonic and Passive Infrared

f. Ultrasonic or Passive Infrared

g. Ultrasonic only

h. Passive Infrared only

i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. One or two RJ-45 port(s) for connection to digital lighting control local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

6. Device Status LEDs, which may be disabled for selected applications, including:

a. PIR detection

b. Ultrasonic detection

c. Configuration mode

d. Load binding

7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

8. Manual override of controlled loads.

9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Detection state

2. Occupancy sensor time delay

3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:

a. Sensitivity: 0-100 percent in 10 percent increments

b. Time delay: 1-30 minutes in 1 minute increments

c. Test mode: Five second time delay

d. Detection technology: PIR, Dual Technology activation and/or re-activation.

e. Walk-through mode

f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.

2. Programmable control functionality including:

a. Each sensor may be programmed to control specific loads within a local network.

b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.

c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.

d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

1) Ultrasonic and Passive Infrared

2) Ultrasonic or Passive Infrared

3) Ultrasonic only

4) Passive Infrared only

3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. Two RJ-45 ports for connection to digital lighting control local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.

6. Device Status LEDs including

a. PIR detection

b. Ultrasonic detection

c. Configuration mode

d. Load binding

7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.

8. Assignment of local buttons to specific loads within the room without wiring or special tools

9. Manual override of controlled loads

10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Detection state

2. Occupancy sensor time delay

3. Occupancy sensor sensitivity, PIR and Ultrasonic

4. Button state

5. Switch lock control

6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:

1. Left button

a. Press and release - Turn load on

b. Press and hold - Raise dimming load

2. Right button

a. Press and release - Turn load off

b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:

1. Load/Scene Status LED on each switch button with the following characteristics:

a. Bi-level LED

b. Dim locator level indicates power to switch

c. Bright status level indicates that load or scene is active

2. The following button attributes may be changed or selected using a wireless configuration tool:

a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

b. Individual button function may be configured to Toggle, On only or Off only.

c. Individual scenes may be locked to prevent unauthorized change.

d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

e. Ramp rate may be adjusted for each dimmer switch.

f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 6 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.

4. Load/Scene Status LED on each switch button with the following characteristics:

a. Bi-level LED

b. Dim locator level indicates power to switch

c. Bright status level indicates that load or scene is active

d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

5. Programmable control functionality including:

a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Button state

2. Switch lock control

3. Switch lock status

C. Two RJ-45 ports for connection to digital lighting control local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.

1. Individual button function may be configured to Toggle, On only or Off only.

2. Individual scenes may be locked to prevent unauthorized change.

3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

4. Ramp rate may be adjusted for each dimmer switch.

5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. All wiring associated with the specified controls system shall be installed within conduit or conduits unless otherwise indicated on the Drawings. Refer to 26 0533.13 - Conduit for Electrical Systems for requirements.

C. Install all room/area devices using manufacturer's factory-tested low voltage cable with pre-terminated RJ-45 connectors.

1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

2. If fixtures have internal digital lighting control Control Modules, ensure that they are also connected with low voltage cable.

3. Install all room to room network devices using manufacturer-supplied network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.

4. Low voltage wiring topology must comply with manufacturer's specifications.

5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

6. All lighting control low voltage wiring jacket colors shall be coordinated with and approved by Owner.

a. If there is no selection provided by Owner, jacket color shall be yellow.

D. All line voltage connections shall be tagged to indicate circuit and switched legs.

E. Test all devices to ensure proper communication.

F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

G. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

H. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

I. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

J. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

K. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

L. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

M. Remote Access for Network Systems: If “REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS” is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Engineer and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.

2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.

3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.

4. Verify that the control of each space complies with the Sequence of Operation.

5. Correct any system issues and re-test.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:

1. Date of test or inspection.

2. Loads per space, or Fixture Address identification.

3. Quantity and Type of each device installed

4. Reports providing each device's settings.

3.4 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:

1. Confirmation of entire system operation and communication to each device.

2. Confirmation of operation of individual relays, switches, and sensors.

3. Confirmation of system Programming, photocell settings, override settings, etc.

4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.5 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 260005 - Basic Electrical Requirements

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 262416 - Panelboards.

1.3 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.

1. Greater than 10 kVA: 104 degrees F maximum.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com

B. Eaton Corporation: www.eaton.com

C. Schneider Electric; Square D Products: www.schneider-electric.us

D. Siemens Industry, Inc: www.usa.siemens.com

E. Source Limitations: Provide transformers produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:

1. Altitude: Less than 3,300 feet.

2. Ambient Temperature:

a. Greater than 10 kVA: Not exceeding 104 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:

1. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

D. Winding Taps:

1. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20

G. Mounting Provisions:

1. 15 kVA through 75 kVA: Suitable for floor or trapeze mounting.

2. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor clean, dry locations: Type 2.

2. Construction: Steel.

a. 15 kVA and Larger: Ventilated.

3. Finish: Manufacturer's standard grey, suitable for outdoor installations.

4. Provide lifting eyes or brackets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:

1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.

2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.

3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 260526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 260553.

3.3 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

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SECTION 262413
SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 260005 - Basic Electrical Requirements.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

H. Section 262300 - Low-Voltage Switchgear.

I. Section 262813 - Fuses: Fuses for fusible switches.

J. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

M. UL 891 - Switchboards; Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:

1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.

2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.

3. Obtain Utility Company approval of switchboard prior to fabrication.

4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.

2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

3. Include documentation of listed series ratings as indicated in Section 26 0573.

C. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

D. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards:

1. ABB/GE: www.geindustrial.com

2. Eaton Corporation: www.eaton.com

3. Schneider Electric; Square D Products: www.schneider-electric.us

4. Siemens Industry, Inc: www.usa.siemens.com

B. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Service Entrance Switchboards:

1. Listed and labeled as suitable for use as service equipment according to UL 869A.

2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.

3. Comply with Utility Company requirements for electrical service.

E. Service Conditions:

1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:

a. Altitude: Less than 6,600 feet.

b. Ambient Temperature:

1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.

2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

F. Short Circuit Current Rating:

1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

H. Bussing: Sized in accordance with UL 891 temperature rise requirements.

1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.

2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

4. Phase and Neutral Bus Material: Aluminum.

5. Ground Bus Material: Aluminum.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

1. Line Conductor Terminations:

a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

b. Main and Neutral Lug Type: Mechanical.

2. Load Conductor Terminations:

a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

b. Lug Type:

1) Provide mechanical lugs unless otherwise indicated.

J. Enclosures:

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).

b. Outdoor Locations: Type 3R.

2. Finish: Manufacturer's standard unless otherwise indicated.

K. Future Provisions:

1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

N. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

O. Owner Metering:

1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.

2. Measured Parameters:

a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.

b. Current (Amps): For each phase and neutral.

c. Frequency (Hz).

d. Real power (kW): For each phase, 3-phase total.

e. Reactive power (kVAR): For each phase, 3-phase total.

f. Apparent power (kVA): For each phase, 3-phase total.

g. Power factor.

3. Meter Accuracy: Plus/minus 1.0 percent.

P. Instrument Transformers:

1. Comply with IEEE C57.13.

2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Connect secondaries to shorting terminal blocks.

4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:

1. Interrupting Capacity:

   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.

   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Molded Case Circuit Breakers:

   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

      1) Provide thermal magnetic circuit breakers unless otherwise indicated.

      2) Provide electronic trip circuit breakers where indicated.

   b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

   c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

      1) Provide the following field-adjustable trip response settings:

         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

         (b) Long time delay.

         (c) Short time pickup and delay.

         (d) Instantaneous pickup.

         (e) Ground fault pickup and delay where ground fault protection is indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 260529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

H. Provide grounding and bonding in accordance with Section 260526.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable circuit breaker tripping function settings as indicated.

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Provide filler plates to cover unused spaces in switchboards.

3.2 FIELD QUALITY CONTROL

A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.1.

E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

G. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

H. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

I. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.3 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

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SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 03 - Concrete: Concrete equipment pads.

D. Section 260005 - Basic Electrical Requirements.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260529 - Hangers and Supports for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

I. Section 262200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

J. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

K. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

O. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include documentation of listed series ratings as indicated in Section 26 0573.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com

B. Eaton Corporation: www.eaton.com

C. Schneider Electric; Square D Products: www.schneider-electric.us

D. Siemens Industry, Inc: www.usa.siemens.com

E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

1. Provide Surge Protective Devices internally mounted within all panels which are specified as part of the Emergency distribution power system.

L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

M. Load centers are not acceptable.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Aluminum.

2. Ground Bus Material: Aluminum.

D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.

2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.

3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.

2. Phase and Neutral Bus Material: Aluminum.

3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.

2. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:

a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

6. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.

d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

7. Do not use tandem circuit breakers.

8. Do not use handle ties in lieu of multi-pole circuit breakers.

9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 260526.

K. Install all field-installed branch devices, components, and accessories.

L. Provide filler plates to cover unused spaces in panelboards.

M. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Fire detection and alarm circuits.

2. Intrusion detection and access control system circuits.

3. Video surveillance system circuits.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test AFCI circuit breakers to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

D. Floor box service fittings.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Section 260005 - Basic Electrical Requirements.

D. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260533.16 - Boxes for Electrical Systems.

G. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

H. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 260583 - Wiring Connections: Cords and plugs for equipment.

J. Section 260935 - Distributed Digital Lighting Control System: Devices for automatic control of lighting, including occupancy sensors, in-wall switches and timers.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in areas listed below:

1. All 15 and 20-ampere 125 and 250-volt nonlocking type receptacles in the areas listed below shall be listed tamper-resistant receptacles, unless otherwise excluded in NEC.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

1. Outlet shall be readily accessible.

H. Provide GFCI protection for outlets serving vending machines. Outlets shall be readily accessible.

2.2 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with gray stainless steel wall plate.

C. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

2.3 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.4 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com

2. Leviton Manufacturing Company, Inc: www.leviton.com

3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com

4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

3. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

E. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

   a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.

2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. USB Charging/GFCI Combination Devices:

1. Meets specifications indicated in this section for USB Charging Devices, GFCI Receptacles and Tamper-Resistant devices.

G. Cable Reel Recptacles:

1. Reel shall have a heavy-duty spring motor, with self-contained rewind and non-sparking rachet assembly, a 4-way roller and adjustable cable stop, and a safety chain. Reel shall lock when desired cable has been payed out, and unlock and retract when cable is pulled to release lock.

2. Reel shall be provided with minimum 25 foot cable rated for 20 amperes with required phase conductors, neutral and equipment grounding conductor. Provide device with NEMA configuration as indicated in drawings.

2.5 WALL PLATES AND COVERS

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com

2. Leviton Manufacturing Company, Inc: www.leviton.com

3. Lutron Electronics Company, Inc: www.lutron.com

4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard.

3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.6 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

B. Above-Floor Service Fittings:

1. Single Service Pedestal Convenience Receptacles:

a. Configuration: One standard convenience duplex receptacle.

C. Flush Floor Service Fittings:

1. Dual Service Flush Combination Outlets:

a. Configuration:

1) Refer to schedule on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

a. Wall Switches: 48 inches above finished floor.

b. Receptacles: 18 inches above finished floor or 6 inches above counter.

2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

SECTION 262813
FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 260005 - Basic Electrical Requirements.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

E. Section 262816.16 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

C. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com

B. Littelfuse, Inc: www.littelfuse.com

C. Mersen: ep-us.mersen.com

2.2 APPLICATIONS

A. Service Entrance:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 260005 - Basic Electrical Requirements.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

G. Section 262813 - Fuses.

H. Section 263600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com

B. Eaton Corporation: www.eaton.com

C. Schneider Electric; Square D Products: www.schneider-electric.us

D. Siemens Industry, Inc: www.usa.siemens.com

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:

1. Comply with NEMA KS 1.

2. Conductor Terminations:

a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

a. Provide means for locking handle in the ON position where indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify enclosed switches in accordance with Section 260553.

3.2 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

SECTION 263100
PHOTOVOLTAIC COLLECTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Photovoltaic system requirements.

B. Photovoltaic modules.

C. Photovoltaic module mounting system.

D. Photovoltaic combiner boxes.

E. Photovoltaic inverters.

F. Charge controllers.

G. Monitoring system.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262816.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021 (Corrigendum).

B. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.

C. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.

D. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

J. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

K. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.

L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Roof-Mounted Arrays: Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.

C. Utility Interconnection:

1. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.

a. Include copies of documentation with submittals.

2. Coordinate with Utility Company to provide utility metering suitable for system requirements.

3. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

C. Design Data:

1. Include electrical calculations for array and associated equipment other than the basis of design products and configuration.

D. Certify that work of this section does not void roof warranty.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Manufacturer’s detailed field testing procedures.

G. Manufacturer's detailed startup procedures.

H. Rebate and incentive documentation.

I. Utility interconnection documentation.

J. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

M. Software: One copy of software provided under this section.

N. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Photovoltaic Modules: Five.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with Utility Company requirements for interconnection.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Specified warranties indicate minimum requirements. Provide additional warranties or extended warranty periods where required to qualify for rebate and incentive programs.

C. Photovoltaic Modules:

1. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.

D. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

E. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

F. Photovoltaic Inverters: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Photovoltaic Modules - Basis of Design: As indicated under product article below.

B. Photovoltaic Modules, Crystalline Silicon:

1. Renewable Energy Corporation (REC) : www.recgroup.com/rec-solar-panels

2. SunPower: www.us.sunpower.com

C. Photovoltaic Module Mounting System:

1. Unirac, Inc: www.unirac.com/#sle.

2. IronRidge, Inc: www.ironridge.com

D. Photovoltaic Combiner Boxes:

1. SolarEdge: www.solaredge.com/us

2. Midnite Solar: www.midnitesolar.com

E. Photovoltaic Inverters:

1. SolarEdge: www.solaredge.com/us

2. Tigo: www.tigoenergy.com

F. Power Optimizers:

1. SolarEdge: www.solaredge.com/us

2. Tigo: www.tigoenergy.com

G. Monitoring System:

1. SolarEdge: www.solaredge.com/us

2. Tigo: www.tigoenergy.com

H. Source Limitations: For each type of component, furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 PHOTOVOLTAIC SYSTEM REQUIREMENTS

A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.

B. System Description:

1. Photovoltaic array is roof-mounted in location indicated on the drawings.

2. Orientation of array is South.

3. System includes interconnection with utility grid (grid-tied system).

4. System does not include battery storage system.

5. System includes monitoring system.

6. Ensure all available federal, state, and utility company rebate and incentive programs available have been secured by owner.

C. Capacity:

1. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.

D. Size:

1. Array: Designed to fit within the same area as the basis of design array.

2. Individual Modules: Same exact size as basis of design module or smaller.

E. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.

F. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

G. Provide products listed, classified, and labeled as suitable for the purpose intended.

H. Provide photovoltaic system and associated components that qualify for available federal, state, and utility company rebate and incentive programs.

I. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.

J. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.

K. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.

L. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

M. Arrange array to minimize shading during peak production periods.

N. Roof-Mounted Arrays:

1. Arrange array such that normal roof drainage is not affected.

2. Arrange array to maintain required safety clearances from edges of roof as indicated.

3. Arrange array to maintain access and clearance requirements for other roof-mounted equipment as indicated.

4. Arrange array to avoid spanning of expansion joints.

2.3 PHOTOVOLTAIC MODULES

A. Acceptable Module Types: Only crystalline silicon modules are acceptable. Thin film modules will not be considered for this project.

B. General Requirements:

1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.

2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.

3. Frame: Anodized aluminum.

4. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.

5. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.

6. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

2.4 BALANCE OF SYSTEM COMPONENTS

A. Photovoltaic Module Mounting System:

1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.

2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.

3. Roof-Mounted Arrays:

a. Provide system compatible with the roof at the installed location.

b. Provide minimum clearance of 3 inches between roof and module for air circulation and drainage.

B. Photovoltaic Combiner Boxes:

1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.

2. Combiner Boxes: Rated for 600 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.

3. Fuseholders: Touch-safe; suitable to accept fuses indicated.

4. Number of Input Circuits: As indicated or as required for termination of strings.

5. Enclosure: NEMA 250, Type 3R, unless otherwise indicated.

6. Provide with capability of current monitoring for individual strings.

C. Photovoltaic Inverters:

1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.

2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:

a. Maximum power point tracking (MPPT).

b. LCD display.

c. Integrated system rapid shutdown.

d. Integral DC disconnect.

e. Communications Interface: Wireless.

3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.

4. Total Harmonic Distortion: Less than five percent.

5. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Outdoor Locations: Type 3R.

D. Enclosed Switches, in Addition to Requirements of Section 262816.16:

1. Switches for DC System: Rated for 600 V DC.

2. Switches Connected to Supply Side of Service Disconnecting Means: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Monitoring System:

1. Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.

2. System communications interfaces to be wired or wireless, with compatible interconnected components.

a. Provide suitable raceway, minimum 3/4 inch trade size, for all required wired connections.

3. System to monitor and record, in 15 minute intervals:

a. Inverter status.

b. Instantaneous power (kW).

c. Daily, monthly, and lifetime energy production (kWh).

d. Display of physical layout of the system with labeled arrays and inverters.

e. Site Location, Weather, Wind speed and direction.

f. Monitoring for individual modules.

g. Fault detection at module level, string level, and system level.

4. System real-time and historical data to be accessible from the following locations:

a. Personal computer(s), via internet connection.

b. Remote public display(s), quantity and location as indicated on the drawings.

5. System to provide alarm notification via e-mail or instant message.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.

B. Roof-Mounted Arrays: Protect roof and adjacent roof-mounted items from damage.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment in accordance with Section 260529.

D. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.

E. Circuiting Requirements. in Addition to Requirements of Section 260519:

1. Wiring Methods:

a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.

b. Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable or listed photovoltaic wire (not routed inside building) for wiring between string(s) and point of interconnection.

c. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.

2. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.

F. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:

1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.

2. Grounded DC Systems: Ensure that there is only one point of system grounding connection to the grounded conductor, including external connections and connections internal to equipment.

G. Identification Requirements, in Addition to Those Specified in Section 260553:

1. Color for Photovoltaic System Identification Nameplates and Labels: White text on red background, unless otherwise required by NFPA 70 or authorities having jurisdiction.

2. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.

3. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".

4. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.

5. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.

6. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.

7. Where the inverter output connection is located in a panelboard on the opposite (load) end from the input feeder location or main circuit location in order to meet requirements of NFPA 70, use identification nameplate or identification label to identify the overcurrent device with the word message "Warning; Inverter output connection; Do not relocate this overcurrent device".

8. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.

9. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.

10. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.

C. Inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.

2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.

3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.

4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.

5. Measure and record voltages at the inverter AC and DC inputs.

6. Measure and record AC output power.

7. Perform inverter functional test.

8. Verify proper operation of monitoring system.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

E. Repair roof or adjacent roof-mounted items damaged as a result of work of this section.

3.5 SYSTEM STARTUP

A. Obtain Owner's approval prior to performing system startup.

B. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

C. Prepare and start system in accordance with manufacturer's instructions.

3.6 CLEANING

A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

SECTION 263213
ENGINE GENERATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:

1. Engine and engine accessory equipment.
2. Alternator (generator).
3. Generator set control system.
4. Generator set enclosure.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Division 23 - Heating, Ventilation and Air-Conditioning (HVAC): Fuel piping.

D. Section 235100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.

1. Includes installation of exhaust silencer specified in this section.

E. Section 260005 - Basic Electrical Requirements.

F. Section 260526 - Grounding and Bonding for Electrical Systems.

G. Section 260529 - Hangers and Supports for Electrical Systems.

H. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 263600 - Transfer Switches.

1.3 REFERENCE STANDARDS

A. MDEQ - Natural Resources and Environmental Protection Act; Current Edition, Including all revisions.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

D. NEMA MG 1 - Motors and Generators; 2021.

E. NFPA 30 - Flammable and Combustible Liquids Code; 2024.

F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 99 - Health Care Facilities Code; 2024.

I. NFPA 110 - Standard for Emergency and Standby Power Systems; 2022.

J. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022.

K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

L. UL 2085 - Protected Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

M. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.

a. Transfer Switches: See Section 263600.

2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.

1. Include generator set sound level test data.

2. Include characteristic trip curves for overcurrent protective devices upon request.

3. Include alternator thermal damage curve upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

E. Fuel Storage Tank Calculations: Indicate maximum running time for generator set configuration provided.

F. Manufacturer's factory emissions certification.

G. Manufacturer's certification that products meet or exceed specified requirements.

H. Provide NFPA 110 required documentation from manufacturer, including but not limited to:

1. Certified prototype tests.

2. Torsional vibration compatibility certification.

3. NFPA 110 compliance certification.

4. Certified rated load test at rated power factor.

I. Manufacturer’s detailed field testing procedures.

J. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

K. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

L. Maintenance contracts.

M. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).

2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.

3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).

4. NFPA 30 (Flammable and Combustible Liquids Code).

5. UL Certified.

6. EPA Certified.

7. Michigan Department of Environmental Quality (MDEQ).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 WARRANTY

A. Refer to Division 01 - General Requirements for additional warranty requirements.

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Packaged Engine Generator Set:

1. Cummins Power Generation Inc: www.cumminspower.com

2. Generac Power Systems: www.generac.com/industrial

3. Kohler Co: www.kohlerpower.com

4. MTU Onsite Energy, a Brand of Rolls-Royce Power Systems: www.mtuonsiteenergy.com

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.2 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:

1. Application: Emergency/standby.

2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:

1. Type: Gaseous (spark ignition).

2. Power Rating: As indicated on drawings, standby.

3. Voltage: As indicated on drawings.

4. Main Line Circuit Breaker(s):

a. Type: Thermal magnetic.

b. Trip Rating: Select according to generator set rating.

E. Generator Set General Requirements:

1. Prototype tested in accordance with NFPA 110 for Level 1 systems.

2. Factory-assembled, with components mounted on suitable base.

3. List and label engine generator assembly as complying with UL 2200.

4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.

5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.

6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:

1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.

2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.

3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).

4. Maximum Load Step: Refer to "Generator Performance Requirements" schedule in Electrical drawings.

5. Motor Starting Capability: Supports starting of motor load indicated with a maximum voltage dip as indicated under "Maximum Load Step" above.

H. Exhaust Emissions Requirements:

1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.

2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Sound Level Requirements:

1. Do not exceed 72 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.

2. Comply with applicable noise level regulations.

J. Interface with building automation system.

2.3 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parallel loads.

B. Engine Fuel System - Gaseous (Spark Ignition):

1. Fuel Source: Natural gas.

2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.

3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:

    a. Carburetor.

    b. Gas pressure regulators.

    c. Fuel shutoff control valves.

    d. Low gas pressure switches.

C. Engine Starting System:

1. System Type: Electric, with DC solenoid-activated starting motor(s).

2. Battery(s):

    a. Battery Type: Lead-acid.

    b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.

    c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.

3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.

4. Battery Charger:

    a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.

    b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.

    c. Recognized as complying with UL 1236.

    d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.

    e. Provide integral DC output ammeter and voltmeter with five percent accuracy.

    f. Provide alarm output contacts as necessary for alarm indications.

5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

D. Engine Speed Control System (Governor):

1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.

2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:

1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.

2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:

1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.

2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.

3. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.

2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

2.4 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:

1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.

2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.

3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

2.5 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:

1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.

2. Generator Set Control Functions:

a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).

b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.

c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.

d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset. Coordinate final location with AHJ.

e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.

f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).

g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.

3. Generator Set Status Indications:

a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.

b. Current (Amps): For each phase.

c. Frequency (Hz).

d. Real power (W/kW).

e. Reactive power (VAR/kVAR).

f. Apparent power (VA/kVA).

g. Power factor.

h. Duty Level: Actual load as percentage of rated power.

i. Engine speed (RPM).

j. Battery voltage (Volts DC).

k. Engine oil pressure.

l. Engine coolant temperature.

m. Engine run time.

n. Generator powering load (position signal from transfer switch).

4. Generator Set Protection and Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:

1) Overcrank (shutdown).

2) Low coolant temperature (warning).

3) High coolant temperature (warning).

4) High coolant temperature (shutdown).

5) Low oil pressure (shutdown).

6) Overspeed (shutdown).

7) Low fuel level (warning).

8) Low coolant level (warning/shutdown).

9) Generator control not in automatic mode (warning).

10) High battery voltage (warning).

11) Low cranking voltage (warning).

12) Low battery voltage (warning).

13) Battery charger failure (warning).

b. In addition to NFPA 110 requirements, provide the following protections/indications:

1) High AC voltage (shutdown).

2) Low AC voltage (shutdown).

3) High frequency (shutdown).

4) Low frequency (shutdown).

5) Overcurrent (shutdown).

c. Provide contacts for local and remote common alarm.

d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:

a. Event log.

b. Communications Capability: Utilize equipment to communicate with building automation system via Bacnet MSTP protocol.. Provide all accessories necessary for proper interface.

c. Remote monitoring capability.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide and install flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2. Generator Set Status Indications:

a. Generator powering load (via position signal from transfer switch).

b. Communication functional.

3. Generator Set Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:

1) Overcrank (shutdown).

2) Low coolant temperature (warning).

3) High coolant temperature (warning).

4) High coolant temperature (shutdown).

5) Low oil pressure (shutdown).

6) Overspeed (shutdown).

7) Low fuel level (warning).

8) Low coolant level (warning/shutdown).

9) Generator control not in automatic mode (warning).

10) High battery voltage (warning).

11) Low cranking voltage (warning).

12) Low battery voltage (warning).

13) Battery charger failure (warning).

b. Provide audible alarm with silence function.

c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.6 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 4 inch high above grade concrete pad constructed in accordance with Section 26 0005 and Division 03 - Concrete. Provide suitable vibration isolators, where not factory installed.

F. Provide required support and attachment in accordance with Section 260529.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.

1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.

2. Do not exceed manufacturer's maximum back pressure requirements.

I. Install exhaust silencer in accordance with Section 235100, where not factory installed.

J. Provide grounding and bonding in accordance with Section 260526.

K. Identify system wiring and components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.

2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.

3. Check for proper oil and coolant levels.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. Provide field emissions testing where necessary for certification.

J. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 CLOSEOUT ACTIVITIES

A. See Division 01 - General Requirements for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of four hours of training.

3. Instructor: Manufacturer's authorized representative.

4. Location: At project site.

3.5 MAINTENANCE

A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

SECTION 263323
CENTRAL BATTERY EQUIPMENT AND INVERTERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured Units.

B. Maintenance Bypass/Isolation Switch.

C. Internal Bypass Switch.

D. Charging/Discharging Circuit.

E. Output Distribution.

F. Display Monitor and Diagnostics.

1.2 RELATED SECTIONS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 260005 - Basic Electrical Requirements.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260533.13 - Conduit for Electrical Systems.

F. Section 260533.16 - Boxes for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260935 - Distributed Digital Lighting Control System.

I. Section 265100 - Interior Lighting.

J. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. ANSI/IEEE C57.110

B. ANSI/IEEE C62.41 Category B3

C. IEEE C57.110 - Recommended Practice for Establishing Transformer Capability When Supplying Non-Sinusiodal Load Currents, 1998.

D. IEEE 519 - Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

E. IEEE C62.41 - Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits, 2002.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction, 2010.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electric Code; Most Recent Edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.

I. NFPA 101- Life Safety Code; Most Recent Edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.

J. NFPA 111 - Standard on Stored Electrical Energy and Standby Power Systems; Most Recent Edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.

K. UL 924 - Standard for Emergency Lighting and Power Equipment; Current Edition, Including all Revisions.

L. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including all Revisions.

M. UL 1778 - Uninterruptible Power Systems; Current Edision, Including all Revisions.

N. FCC Article 15, Section J, Class A.

1.4 SYSTEM DESCRIPTION

A. This specification describes the features and design of an emergency lighting inverter system which is single phase, continuous duty, and features a seamless transfer inverter. The system shall be designed to supply reliable, isolated, clean, regulated emergency power for emergency lighting and associated controls. A ferroesonant transformer, microprocessor controlled solid state PWM inverter and long lasting battery pack must provide immunity to all line disturbances and power interruptions with no break in AC output power. Power factor correction and harmonic attenuation shall be provided.

B. A synchronous inverter must produce a true uninterrupted output in any mode of operation. A self-diagnostic monitoring alarm system shall continuously advise system status. Provide with audible alarm.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.6 WARRANTY

A. The manufacturer shall guarantee all systems to be free from material defects and workmanship for a period of 1 year following shipment from the factory. During the 1 year period, a factory trained and authorized service engineer will perform an annual preventative maintenance inspection to include a full 90 minute battery run test and document the test to comply with NFPA 101 and applicable annual code requirements.

B. Battery warranty shall be 15 years; prorated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Myers Power Products, Inc.: www.myerspowerproducts.com

B. Hubbell Dual-Lite: www.hubbell.com

C. Controlled Power Company: www.controlledpwr.com

D. Engineer pre-approved alternate.

2.2 MANUFACTURED UNITS

A. The system shall include an output ferroresonant transformer, microprocessor controlled PWM inverter, highly filtered current and voltage limited precision battery charger, membrane diagnostic display, output power distribution, pre-wired & pre-tested batteries in a matching enclosure and an external wall mounted make before break maintenance bypass switch. The inverter and battery cabinets shall be provided on lockable casters. The battery cabinet shall be designed to plug into the inverter cabinet via a factory provided DC connector.

B. System shall be provided with data connection for connection to Building Management System.

C. Automatic system operating functions shall include:

1. Normal Operation: The load shall be supplied with voltage regulated & isolated power derived from the ferroresonant transformer. When utility AC power is present, the battery charger shall maintain a ripple free float charge on the batteries.

2. Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, battery power shall be converted by the PWM inverter and filtered through the on-line ferroresonant transformer. There shall be no break or interruption of power to the load upon failure or restoration of the commercial AC power. Any transfer time resulting in a break in power is unacceptable.

3. Automatic Restart: In the case of a commercial power outage that exceeds the 90 minute battery run time required, the output of the inverter shall shut off, but automatically restart once commercial AC power returns. Recharging of the batteries shall then commence immediately.

4. Automatic 30 Day Battery Testing. The unit shall automatically test the batteries at 30 day intervals and record 6 sequential measurements into memory. The battery test results shall include a Pass/Fail, 6 DC voltage readings and a date time stamp. The test result data shall be logged in a non-volatile memory and accessible from the front panel display.

2.3 MAINTENANCE BYPASS / ISOLATION SWITCH

A. The system shall include an external, wrap around, wall mounted, make-before-break maintenance bypass switch.

B. The maintenance bypass switch shall provide complete isolation of the inverter output terminals from the lighting circuits.

C. When the lighting circuits are supplied from the utility through the maintenance bypass switch, the AC input terminals of the inverter system shall remain energized to permit lighting inverter operational testing, while the lighting inverter output terminals remain isolated from the load.

2.4 OPTIONAL INTERNAL BYPASS SWITCH

A. If the input AC nominal voltage is different from the specified AC nominal output voltage, then an internal make before break bypass switch shall be provided. The specified voltage transformation must be maintained through the internal ferroresonant transformer.

2.5 CHARGING / DISCHARGING CIRCUIT

A. The system shall incorporate sealed, maintenance free, gas recombinant, self venting, suspended electrolyte batteries, with no gel contaminant. The batteries shall be pre-packaged and pre-tested, provided in a separate enclosure designed to plug into the inverter via a DC connector. Backup time will be a minimum of 90 minutes per U/L 924.

B. The capacity of the internal charger shall be adequate to recharge fully discharged batteries to 90% + capacity in 24 hours. External battery chargers will not be accepted.

C. The charger shall be sized and matched to the inverter system.

D. The internal battery charger shall be highly filtered, current limited and voltage regulated and sustain a float charge on the batteries continuously affording maximum battery life. Charging current shall not exceed the battery manufacturer's specifications of 25% of the amp hour rating.

E. The battery charger shall maintain the float voltage to 2.27 VPC, with a final voltage of 1.75 VPC. The manufacturer will factory test and provide test results with inverter system.

2.6 OUTPUT DISTRIBUTION

A. The inverter shall include input and output terminals for hardwired connections. The terminals shall have easy access. The manufacturer will provide the recommended input and output conduit knockouts.

B. Provide Optional Output branch normally ON circuit breakers shall be flush mounted on the rear of the enclosure. Load connections shall be made at the breaker, neutral bus and ground bus as indicated on manufacturer's drawings.

2.7 DISPLAY MONITOR AND DIAGNOSTICS

A. Alarms shall be provided for the following faults:

1. On Battery Power
2. Charger Failure
3. Bypass
4. Alarm Silence Push Button
5. Low Battery
6. High Temperature

B. Auto Logging Analyzer:

1. (ALA) shall be a user friendly, precision metering and data acquisition system analyzer. The ALA shall provide adaptive diagnostics true RMS metering, power analyzation and display of all electrical parameters of the inverter. Single well-defined push buttons shall access electrical parameters, alarm messages, operating set points and log functions. A backlit, 40 character alphanumeric LCD display shall provide extremely sharp visual resolution of data and titles.

C. Display and Functions:

1. True RMS
2. AC Input Voltage
3. AC Output Voltage (L1-N, L1-L2)
4. AC Output Current (L1, L2)
5. Percent Load
6. Crest Factor (L1, L2)
7. DC Charging Voltage
8. DC Charging Current
9. Battery Bus Voltage
10. Output Frequency

11. Back-Up Time Remaining

12. Time/Date

13. Power Factor- kW/kVA

14. Load KW

D. Automatic Battery Test

1. Programmable automatic battery test period (weekly, monthly, quarterly).

2. Selectable auxiliary alarm during automatic/manual battery test.

3. Proprietary manual test switch.

2.8 SYSTEM PERFORMANCE

A. The system shall operate continuously at full output without derating while subjected to ambient temperatures of 0ºC to 40ºC.

B. The system shall emit a maximum of 50dB to 55dB acoustical noise measured at 1 meter.

C. The system shall be capable of continuous full load operation at the specified kilowatt, with a self correcting power factor greater than 0.95 (approaching unity).

D. Input Voltage Range:

1. The system shall accept standard nominal voltages as specified on drawings..

E. Output Voltage Range:

1. The system output shall provide standard nominal voltages as specified on drawings.

F. Operating Frequency:

1. The unit shall operate from a 60 Hertz, + 2.5Hz AC source.

G. The output frequency shall be 60Hz, plus or minus 0.2 Hz under full range load while in the battery operation mode.

H. The unit shall operate, without battery usage, from an input range of +10% to -15% from nominal.

I. Voltage Regulation:

1. The voltage regulation of the inverter shall be ± 3% from output nominal.

J. Overload Rating:

1. The system shall provide for an overload of 125% for ten (10) minutes.

K. Efficiency at rated load shall be 89% to 91% for sizes ranging from 5kW to 15kW and 86% to 88% for sizes ranging from 16kW to 18kW.

L. Output Harmonic Distortion:

1. The output shall be maximum 3% THD for any single harmonic. Reflected, load generated harmonics shall be attenuated to 23dB at the system input. The system shall be capable of non-linear loads with a crest factors of 3:1.

M. Input Current Distortion:

1. The input current distortion shall be below 5% THD.

N. Voltage Spikes and Electrical Noise:

1. The system shall have 3000:1 spike (noise) attenuation and will exceed ANSI/IEEE C62.41 requirement for a category B3 wave.

O. Common Mode Noise Attenuation: 120dB (L-G).

P. Transverse Mode Noise Attenuation: 70dB (L-L) (3dB @ 1KHz; -20dB per decade).

Q. The system shall be capable of withstanding a 150% surge without the need of switching to a static bypass.

R. Provide with audible alarm.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units plumb and level.

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SECTION 263600
TRANSFER SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:

1. Automatic transfer switches.

2. Manual transfer switches.

3. Remote annunciators.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads for floor mounted units.

C. Division 14 - Conveying Equipment: For interface with transfer switch.

D. Section 260005 - Basic Electrical Requirements.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260529 - Hangers and Supports for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260573 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

I. Section 262816.16 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

J. Section 263213 - Engine Generators: For interface with transfer switches.

1. Includes code requirements applicable to work of this section.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2022.

G. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.

a. Engine Generators: See Section 263213.

2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work with placement of supports, anchors, etc. required for mounting.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Maintenance contracts.

E. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).

2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 263213.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Transfer Switches:

1. ASCO Power Technologies: www.ascopower.com

2. Same as manufacturer of engine generator(s) used for this project.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.2 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:

1. Utilize open transition transfer unless otherwise indicated or required.

D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

E. Automatic Transfer Switch:

1. Transfer Switch Type: As indicated on the drawings.

2. Transition Configuration: As indicated on the drawings.

3. Voltage: As indicated on the drawings.

4. Ampere Rating: As indicated on the drawings.

5. Neutral Configuration: Solid neutral (unswitched), except as indicated.

6. Features:

   a. Provide signal connection to elevator programming hub.

F. Manual Transfer Switch:

1. Voltage: As indicated on drawings, or to match generator voltage if not indicated.

2. Ampere Rating: As indicated on drawings, or to match circuit breaker in generator if not indicated.

3. Neutral Configuration: Solid neutral (unswitched), except as indicated.

4. Features:

   a. Kirk-key interlocked circuit breakers as indicated within details.

   b. NEMA 3R rated enclosure.

   c. Phase rotation monitor.

   d. Mechanical lug terminations per phase, sized to accept wiring as indicated.

   e. Termination cabinet with 'camlock' style connectors for portable generator connection.

G. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

H. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

I. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

J. Switching Methods:

1. Open Transition:

a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.

2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

K. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

L. Enclosures:

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

2. Finish: Manufacturer's standard unless otherwise indicated.

M. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as indicated on the drawings.

N. Automatic Transfer Switches:

1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.

2. Control Functions:

a. Automatic mode.

b. Test Mode: Simulates failure of primary/normal source.

c. Voltage and Frequency Sensing:

1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.

2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.

3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.

d. Outputs:

1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).

2) Auxiliary contacts; two set(s) for each switch position.

(a) Provide contact connection between stand-by transfer switch and the elevator control system to limit operation of only one elevator at a time while the system is operating on generator power.

e. Adjustable Time Delays:

1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.

2) Transfer to alternate/emergency source time delay.

3) Retransfer to primary/normal source time delay.

4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.

f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.

g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.

3. Status Indications:

a. Connected to alternate/emergency source.

b. Connected to primary/normal source.

c. Alternate/emergency source available.

4. Automatic Sequence of Operations:

a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.

b. When alternate/emergency source is available, life safety system transfer switch shall transfer load to alternate/emergency source after programmable time delay (maximum time to transfer shall be 10 seconds to comply with life safety requirements).

c. After programmable time delay (30 seconds), the stand-by transfer switch shall transfer load to alternate/emergency source.

d. After programmable time delay (60 seconds), the optional transfer switch shall transfer load to alternate/emergency source.

e. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.

f. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

g. The prioritization of power systems shall be in the following order:

1) Life safety and fire pump

2) Stand-by

3) Optional

h. Any overload or event that limits the capacity of the generator system, shall open the transfer switches of the systems starting with the lowest priority system.

O. Manual Transfer Switches:

1. Description: Transfer switches with manually initiated transfer between sources; mechanically operated and mechanically held.

2. Provide with means for generator docking, cam-lock connections or similar.

P. Remote Annunciators:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2. Transfer Switch Status Indications:

a. Connected to alternate/emergency source.

b. Connected to primary/normal source.

c. Alternate/emergency source available.

Q. Interface with Other Work:

1. Interface with engine generators as specified in Section 263213.

2. Interface with elevators as specified in Division 14.

3. Interface with building automation system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 260529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Automatic Transfer Switches:

1. Inspect and test in accordance with NETA ATS, except Section 4.

2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 MAINTENANCE

A. Provide to Owner at no extra cost, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

SECTION 263613
GENERATOR DOCKING STATIONS

PART 1 GENERAL

1.1 SECTION INCLUDE

A. Generator Docking Stations

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads

C. Section 260005 - Basic Electrical Requirements.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment or equipment and associated protective devices specified in this section.

H. Section 263213 - Engine Generators: For interface with transfer switches.

I. Section 263600 - Transfer Switches.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems 2021.

D. NFPA 70 - National Electrical Code - Most recent edition adopted by Authority Having Jurisdiction, Including all applicable Amendments and Supplements.

E. NFPA 101 - Life Safety Code 2015.

F. NFPA 110 - Standard for Emergency and Standby Power Systems 2015.

G. UL 50 - Electrical Equipment Enclosure Testing 2015

H. UL 1008 - Transfer Switch Equipment Current Edition, Including all revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of docking stations to be installed with work provided under other sections or by others:

a. Engine Generators: See section 263213 - Engine Generators.

b. Transfer Switches: See section 263600 - Transfer Switches.

2. Coordinate the work with other trades to avoid placement of obstructions with the dedicated equipment spaces and working clearances required by NFPA 70.

3. Coordinate the arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection examination, preparation, and installation of product.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Trystar: www.trystar.com

2. ASCO: www.ascopower.com/us/en

3. Eaton Corporation: www.eaton.com/en-us

2.2 GENERAL REQUIREMENTS

A. Enclosure

1. NEMA 3R Rain-Tight Aluminum Enclosure

a. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.

b. NEMA 3R Integrity shall be maintained while temporary cabling is connected during use

c. Front and Side shall be accessible for maintenance

d. Top, Side, and Bottom shall be accessible for permanent cabling

2. Powder coat

a. Paint after fabrication shall be Hammer tone Gray

B. Phase, Neutral, and Ground Busbar

1. Material: Silver-plated Copper

2. Equipment Ground Bus: bonded to box.

3. Isolated Ground Bus: insulated from box.

4. Ground Bus: 50% of phase size.

5. Neutral Bus: Neutral bus rated 100% percent of phase bus.

C. Temporary generator connectors shall be Camlok style mounted on gland plate.

1. Camlok shall be 16 Series model and color coded according to system voltage requirements.

2. Camlok connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable.

3. Camlok connection shall be protected against accidental contact while not in use.

D. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier.

E. Short Circuit & Withstand Rating shall be minimum 65kaic unless otherwise idicated on drawings.

F. Refer to contract documents for listed voltage and amerage requirements.

G. Factory Installed Phase Rotation Monitor Device:

1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and shall be factory installed.

H. [Optional Breaker Disconnects as Indicated on Project Drawings and Manufacturer Submittal Drawings:]

1. UL 489 Listed Breaker

2. Breakers shall be removable for service and maintenance

I. Mechanically interlocked permanent main breaker to temporary main breaker.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are satisfactory for installation prior to starting work.

B. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 INSTALLATION

A. Surface, Flush or Base Mounted: Determined by Application

1. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

3.3 FIELD QUALITY CONTROL

A. Third Party Tests and Inspections to include the following:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results. Include notation.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 26 0005 - General Electrical Requirements.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 262300 - Low-Voltage Switchgear.

D. Section 262413 - Switchboards.

E. Section 262416 - Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:

1. ABB/GE: www.geindustrial.com

2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com

3. Schneider Electric; Square D Brand Surgelogic Products; _____: www.surgelogic.com/#sle.

4. Raycap; www.raycap.com

B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Switchgear: See Section 262300.

2. Switchboards: See Section 262413.

3. Panelboards: See Section 262416.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.

2. Surge Current Rating: Not less than 160 kA per mode/320 kA per phase.

3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

5. Diagnostics:

a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.

b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

2.4 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards.

B. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.

2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

5. Diagnostics:

a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.

b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

2.5 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.

2. Surge Current Rating: Not less than 50 kA per mode/100 kA per phase.

3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

5. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

6. Diagnostics:

   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.

   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

   d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Ballasts and drivers.

D. LED emergency power supply units.

E. Emergency Lighting Control Units (Transfer Switches)

F. Accessories.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

C. Section 260005 - Basic Electrical Requirements.

D. Section 260533.13 - Conduit for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.16 - Boxes for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260935 - Distributed Digital Lighting Control System: Devices for automatic control of lighting, including occupancy sensors, daylighting controls, networked control stations and motion sensors.

I. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

J. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

C. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

D. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

E. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70 and NFPA 101.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70 and NFPA 101.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s), light engines, drivers and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.

C. Dimmable LED Drivers: Comply with Section 260935 - Distributed Digital Lighting Control System.

2.4 EMERGENCY LIGHTING CONTROL DEVICES (TRANSFER DEVICES)

A. Manufacturers:

1. Philips Emergency Lighting Bodine: www.philips.com/bodine

2. Iota Engineering: www.iotaengineering.com

3. Engineer pre-approved equal

B. General Requirements:

1. The emergency lighting control device shall work in conjunction with an auxiliary generator or a central inverter system to power light fixtures for egress lighting regardless of fixture wall switch position.

2. All units shall be UL924 listed and approved.

C. Operation:

1. Device shall sense loss of normal power and switch the AC driver input power connected to an unswitched generator (or central inverter) supplied lighting circuit.

2. The device shall be capable of bypassing the wall switch when the auxiliary generator (or central inverter) powers.

3. Unit shall be capable of 120/277 volt operation.

D. Equipment:

1. Emergency Lighting Control Device - 3 Amp

a. For use within a single luminaire. Device shall be suitable for indoor and damp locations and capable of being used with fluorescent or LED lighting loads. Device shall be UL listed for installation inside, on top of or remote from the fixture. Shall include power loss sensing, UL924 listed and approved.

2. Emergency Lighting Control Device - 20 Amp

a. For use adjacent to local switching means. Device shall be suitable for indoor and damp locations and capable of being used with incadescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.

3. Branch Circuit Emergency Lighting Transfer Switch

a. Mounted onto junction box type, verify with field conditions. Device shall be suitable for indoor, damp and plenum (UL 2043) locations and capable of being used with incadescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

B. Verify that suitable support frames are installed where required.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.

2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.

4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

5. See appropriate Division 09 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:

1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

2. Install canopies tight to mounting surface.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding emergency lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Identify luminaires connected to emergency power system in accordance with Section 260553.

N. Install lamps in each luminaire.

3.3 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

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SECTION 265600
EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts and Drivers.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Section 260005 - Basic Electrical Requirements.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.16 - Boxes for Electrical Systems.

G. Section 260935 - Distributed Digital Lighting Control System: Automatic controls for lighting including outdoormotion sensors and outdoor photo controls.

H. Section 262726 - Wiring Devices: Receptacles for installation in poles.

I. Section 265100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

C. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

D. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

E. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

F. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

G. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2022.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

I. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.

2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. Exposed Hardware: Stainless steel.

2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

B. Verify that suitable support frames are installed where required.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 260529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

SECTION 27 0000 – GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes general administrative and procedural requirements. The following requirements are included to supplement the requirements specified in Division 1 Specification Sections.

B. Along with the drawings and details, these specifications establish the requirements for the new Willow School

C. The project consists of the following major systems:

1. Structured cabling system
2. Audiovisual systems
3. Security systems
4. PA system
5. Clock system

1.3 GENERAL REQUIREMENTS

A. Bidders must submit a bill of materials with the proposal. BOM must list all major components, quantities, and extended price. BOM is provided for information only to assist in evaluating the various bid proposals. Bidder agrees to the scope of work outlined in the bid documents.

B. The bid documentation does not provide for every component or requirement of installation; however, it does establish minimum requirements for the system. The final solution shall be well documented within the bid proposal. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the work. Installation within a reasonable distance from the locations shown on the drawing will be performed without additional cost.

C. The submitting of a bid response implies that the Contractor understands the conditions under which the work must be conducted. Additional charges will not be allowed because of failure to make this examination or to include all materials and labor to complete the work.

D. If backend systems (power supplies, master clock, master PA console, etc.) need dedicated or hardwired electrical connections, each Contractor is to provide the requirements for their systems as part of the bid response. If the electrical requirements are not specifically called out in the bid response, the Contractor will subcontract to a licensed electrical contractor to complete the electrical work as part of the Contractor's cost.

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E. Additional information provided with a bid response shall be used in the evaluation of bids, but do not replace the requirements established by the contract documents (project manual, drawings, specifications, etc.). The Technology Designer and Owner will not be responsible for reviewing equipment lists for completeness or conformance to the contract documents. Lists of material, bills of material, etc. submitted by the contractor do not replace the submittal requirements and do not replace the requirements established by the contract.

F. The Contractor shall provide the services necessary to engineer, procure, install, test, and certify the systems described in the bid documents conforming to manufacturer specifications and applicable industry standards.

G. All materials and equipment shall be furnished complete with all accessories normally supplied for a complete and operating system. All materials and equipment shall be new and shall be standard products in production and shall be of the manufacturer's current design. Any items with a known end of manufacture date will be specifically called out for approval before procurement. All equipment of the same or similar systems shall be by the same manufacturer.

H. The methods of implementation shall be in accordance with the latest issue of the various authorities including but not limited to:

1. ANSI American National Standards Institute
2. ASTM American Society for Testing and Materials
3. BICSI Building Industries Consulting Services International
4. EIA Electronics Industries Association
5. FCC Federal Communications Commission
6. ICEA Insulated Cable Engineers Association
7. IEEE Institute of Electrical and Electronics Engineers
8. ISO International Organization for Standardization
9. NEC National Electrical Code
10. NECA National Electrical Contractors Association
11. NEMA National Electrical Manufacturer's Association
12. NFPA National Fire Protection Association
13. TIA Telecommunications Industry Association
14. UL Underwriters Laboratories, Inc.

I. Notify the Technology Designer before the bid period question deadline should any changes in bid documents be required to conform to recommended manufacturer guidelines or the applicable codes, rules, or regulations. After entering into Contract, make all changes required to conform to applicable guidelines, ordinances, rules, and regulations without additional expense to the Owner.

J. Any required permits, licenses, inspections, approvals, and fees for the work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules, and regulations. Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

K. Contractor shall comply with all rules and regulations of local utility companies. Coordinate requirements with applicable companies supplying service and include the cost of all such items in proposal.

L. Each contractor is to provide any backboards and access panels necessary for their installation. Materials are to be fire-rated. Provide D-rings, spaced no greater than 12" apart, to support cables routed to and along backboards.

M. Each contractor is to use plenum rated cabling and accessories throughout the project.

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N. Where not provided by the electrical contractor, each contractor is required to provide their own penetrations, sleeves, and cores with firestopping. Sleeves and cores shall have nylon bushings.

O. Install surge suppressors where ac-power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL 1449. Install surge suppressors at the devices' power-line terminals. All surge suppression devices shall warranty protection of all downstream equipment.

P. Unit prices established for the project shall remain in effect throughout the duration of the contract.

1.4 DEFINITIONS

A. ADA: Americans with Disabilities Act.

B. AIA: American Institute of Architects.

C. FBO: Furnished By Others.

D. IR: Infrared.

E. MC: Main Cross-Connect. (Applies to MDF or Headend references).

F. OFE: Owner Furnished Equipment. (Applies to OFCI references)

G. POE: Power over Ethernet.

H. RF: Radio Frequency.

I. TR: Telecommunications Room. (Applies to MDF or IDF references).

1.5 SUBMITTALS

A. All submittals shall be complete and organized by related items. Incomplete submittal packets will be returned unchecked. Any modifications to or deviations from the bid documents shall be specifically highlighted on the submittals. In addition to requirements specified in Division 1, include the following:

B. Lists of material, bills of material, etc. submitted by the contractor do not replace the submittal requirements and do not replace the requirements established by the contract documents. The Technology Designer and Owner will not be responsible for reviewing lists of material for completeness or conformance to the contract documents.

C. Copies of any professional licenses or certifications requested in the documents.

D. Product Data: For each product indicated in the specifications or included in the scope, provide a product data sheet in PDF format. Data sheets indicating multiple products must have the applicable product highlighted or marked.

E. Shop Drawings: Shop drawings are to be provided in both PDF and native electronic format (eg AutoCAD, Revit, Excel format, etc.).

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F. Closeout documents will include a spreadsheet identifying system components, installed location, model number, serial number, label designation, and any other pertinent data. Submittals shall include spreadsheet format for approval.

1.6 QUALITY ASSURANCE

A. The Contractor and their Sub-Contractors shall be experienced in all aspects of the work and shall demonstrate direct experience on recent systems of similar type, complexity, and size.

1. Upon request, Contractor shall furnish for both the Contractor and all Sub-Contractors information on the corporation, project manager, and installers indicating recently completed projects, technical experience, and completed training.
2. The Contractor shall maintain consistent staffing for Project Management and lead installers throughout the project, except for illness or loss of personnel. The Technology Designer and Owner reserve the right to require staffing substitutions if deemed beneficial to satisfactory completion of the project.

B. The Contractor shall utilize equipment from manufacturers regularly engaged in the production of similar systems and components for a minimum of five (5) years.

C. The Contractor must be a certified reseller and installer for the products/solutions provided and/or installed.

D. The Contractor shall install in accordance with all applicable codes and standards, including federal, state, and local codes and authorities.

1.7 COORDINATION

A. Contractor is to coordinate with other construction and technology contractors.

B. Contractors shall be responsible for coordinating their configuration with the Owner, access providers, and other integrators whose systems will interact. If problems occur during implementation or commissioning, all contractors will be responsible for ongoing/additional coordination regarding configuring, testing, and troubleshooting of related/ inter-related devices until a resolution acceptable to the Owner is achieved. This includes coordination with outside agencies such as telephone service providers and internet service providers when necessary

C. Coordinate layout, rough-in requirements, and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

D. Coordinate with the appropriate utility companies for installation and cutover.

E. Where multiple contractors will share a common pathway or faceplate, coordinate requirements and installation.

F. Contractor shall uncover Work as needed for review by the Owner, Technology Designer, Architect, Construction Manager, or contractors performing related work. Work uncovered for observation will be replaced at the Contractor’s expense without change in the Contract Time or Contract Sum.

G. Where the cabling and A/V contractor(s) will be sharing a faceplate, the A/V contractor is to provide the faceplate and any blank modules. The faceplate must be able to accept the

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termination jack chosen by the data cabling contractor. Contractors shall coordinate all faceplate and termination requirements.

1.8 WARRANTY

A. All division 27 and 27 systems shall be provided with a three (3) year warranty unless noted otherwise in scope specific specification sections. Manufacturer and contractor warranties are to include the entire system (equipment, software updates, licensing, installation, etc.).

B. Unless a specification section has a specific requirement, manufacturer warranties for each component shall begin on the date that equipment is delivered from the manufacturer/supplier. The contractor warranty period shall begin at the date indicated on the certificate of substantial completion or the date of Owner acceptance (to be received in writing and approved by the Owner), whichever comes later.

C. Contractor is to provide:

1. Evidence of the manufactures warranty end date.
2. Procedures for warranty issues (e.g. phone number to call, warranty ID numbers, etc.)
3. Documentation for all manufacturer's warranties including the operating conditions required for the warranty.
4. Contractor's guarantee.

D. The manufacturer warranty shall include phone support and software assurance including patches, updates and version upgrades for both major and minor releases throughout the warranty period.

E. The Owner shall not be responsible for additional charges during the equipment warranty period. Labor, service charges, trip charges, etc. to configure and install equipment during the warranty period shall be included in the contractor's warranty.

F. Contractor is to register all equipment in the Owner's name, not the Contractor's. All manufacturer warranty and support must be available to the Owner directly and not required to channel through the Contractor, distributor, or other entity.

G. When a manufacturer's warranty is provided, it is the Bidder's responsibility to make sure the manufacturer's records reflect the correct warranty period start date as established in the contract terms.

H. The contractor warrants the system to be free of product, workmanship, and configuration defects and will inspect and repair the system before the next school day (or within 48 hours during school breaks) during the warranty period at no additional cost to the Owner. The Contractor shall respond on site within four (4) hours notice, and without cost to the Owner, during this warranty period. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions. No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law.

I. Contractor will be responsible for repairing/replacing any aspect of the system unless a specific specification section states that the Owner will install replacement equipment.

J. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

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PART 2 - PRODUCTS

2.1 GENERAL

A. Contractor is responsible for ensuring that no asbestos containing building materials (ACBM) are used and must certify to the Owner and Technology Designer that none was used.

B. Any equipment, software, system, etc. with time dependent functions (e.g. bell systems) shall automatically adjust for daylight saving time without human intervention.

2.2 MANUFACTURERS

A. Permit Competition. The name of a model, manufacturer or brand in this RFP shall not be considered as exclusive of other brands. Brands and models specified in this RFP are preferred. Owner expects all supplies, materials, equipment, or products bid by a Bidder to meet or exceed the specifications set forth in this RFP. Further, it is Owner's intent that this RFP permit competition. Accordingly, the use of any patent, proprietary name or manufacturer's name is for demonstrative purposes only and is not intended to curtail competition. Whenever any supplies, material, equipment or products requested in this RFP are specified by patent, proprietary name or by the name of the manufacturer, unless stated differently, such specification shall be considered as if followed by the words "or comparable equivalent," whether or not such words appear. Owner, in its sole and absolute discretion, shall have the right to determine if the proposed equivalent products/brands submitted by Bidder meet the specifications contained in this RFP and possess equivalent and/or better qualities. It is the Bidder's responsibility to notify Owner in writing if any specifications or suggested comparable equivalent products/brands require clarification by Owner prior to the Due Date for Bids. All Bid deviations from specifications must be noted on the Proposal Form.

B. Base bid shall utilize manufacturers listed in the applicable specification sections. Contractor may include deviations as voluntary alternates in addition to the base bid, not in lieu of the base bid.

C. The Owner expects all supplies, materials equipment or products proposed by a Bidder to meet or exceed the Specifications set forth in the Bidding Documents. Further, it is the Owner's intent that the Bidding Documents permit competition. Accordingly, the use of any patent, proprietary name or manufacturer's name is for demonstrative purposes only and is not intended to curtail competition. Whenever any supplies, material, equipment or products requested in the Bidding Documents are specified by patent, proprietary name or by the name of the manufacturer, unless stated differently, such specification shall be considered as if followed by the words "or comparable equivalent," whether or not such words appear. The Owner, in its sole and absolute discretion, shall have the right to determine if the proposed equivalent products/brands submitted by Bidder meet the Specifications contained in the Bidding Documents and possess equivalent and/or better qualities. It shall be the Bidder's responsibility to notify the Owner in writing if any Specifications or suggested comparable equivalent products/brands require clarification by the Owner prior to the Due Date for Bid Proposals.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Failure or omission of the Contractor to examine the site or documents does not relieve the Contractor. No additional payment will be made to the Contractor for failure to comply.

C. Review building plans and installations to confirm outlet and conduit installation and location. Check outlets, conduits, raceways, cable trays, and other elements in the proposed pathways for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation in compliance with manufacturer requirements.

D. Device locations shown on drawings are diagrammatic only and may not represent intended location due to conflicts with other CAD symbols, room names, etc. Field verify conditions and coordinate device locations with other trades. Devices shall be installed to perform optimally for the usage and conditions of the space. Notify Barton Malow of conflicts that negatively affect performance prior to installation.

E. Contractor shall choose appropriate mounting method and materials for each location based on manufacturer's requirements, wall construction, building structure, etc.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DEMOLITION [Not Used]

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3.3 INSTALLATION

A. Equipment that extends more than 4” from the wall will be mounted above 80” above finished floor unless reviewed and approved by Technology Designer or Owner.

B. Consult with the Owner’s Representative as to the method of completing work to avoid interfering with the Owner’s operation. All systems shall remain operational and shall only be interrupted at times coordinated with the Owner’s Representative.

C. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans or specifications.

D. The Contractor shall be familiar with the site and the rooms to ensure a proper installation. The final installation methods are left to the discretion of the contractor in accordance with this specification, within standards of generally accepted workmanship, and in accordance with manufacturer’s recommended installation practices.

E. The Contractor shall protect equipment and components during installation. Damage resulting from the Contractor’s work shall be promptly replaced or repaired at the Contractor’s expense.

F. The Contractor shall provide all lifts and temporary supports necessary to accomplish their installation.

G. The Contractor shall accomplish all cutting, removal and replacement of ceiling tile, drilling, coring and patching of walls, floors, casework, and ceilings required to complete their work. Contractor is responsible for replacing any damaged tiles and cleaning the ceiling grid upon completion of their work.

H. Contractor to ensure Owner and Technology Designer have reviewed above ceiling or concealed work before reinstalling ceiling tiles or other obstructions. If work is performed in occupied areas where ceiling tiles or other obstructions must be re-installed upon completion of work, Contractor will be required to remove and reinstall in selected areas for inspection by Owner or Technology Designer.

I. The Contractor, in accordance with all applicable codes, shall provide fire and smoke stopping through all partitions. Verify that penetrations of rated fire walls are made using products labeled for type of partition penetrated.

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J. All cables within racks, cabinets, or enclosures will be cable wrapped with hook and loop tape (Velcro) at no greater than one-foot intervals. Cabling housed in wiring management shall be tied at no less than two-foot intervals.

K. Due to field conditions or other situations, installation locations may have to be relocated a reasonable distance from the plan location. Unless relocations, modifications and reengineering are consistently or substantially unfavorable to either the Contractor or the Owner, there will be no additional charge or credit for this work.

L. No additional compensation will be provided for moving installed equipment for reasons including, but not limited to:

1. Performance issues.
2. Failure to coordinate with other trades for existing conditions and renovations or new construction.
   a. All drawings (including Architectural, Mechanical, Electrical, etc.) are available for review at the jobsite.
3. Locations deviating from design drawings (unless approval has been obtained prior to installation).
4. Failing to follow manufacturer's recommendations.

M. The lack of permanent power does not relieve contractor of installation requirements as dictated in the specifications. If permanent power is not available, contractor must provide temporary power (e.g. UL approved extension cords) to complete installation, configuration, and testing of equipment (e.g. projectors, interactive whiteboards, etc.). Extension cords and/or other means of temporary power are to be removed immediately after the initial installation/configuration. At the time permanent power is completed, contractor to return to make final equipment connections and any necessary adjustments. Refer to the safety section of the project manual for guidelines of proper use with regards to temporary power.

3.4 CLEANING

A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.

B. Contractors working above ceiling or drilling are to bring their own vacuums unless the building custodian allows theirs to be used.

C. Contractor shall clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

3.5 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Equipment and materials shall be protected from theft, injury, or damage. Equipment set in place must be provided with temporary protection.

B. Provide adequate storage for all equipment and materials delivered to the site. Owner shall not be required to provide secure storage but will attempt to accommodate the Contractor's requirements.

C. Contractor will be required to protect any Owner-Furnished-Contractor-Installed (OFCI) equipment and will be responsible for replacing any missing or damaged equipment.

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3.6 IDENTIFICATION

A. Unless noted otherwise, use logical and systematic designations for facility's architectural arrangement and nomenclature.

B. Contractor is responsible for permanently identifying all major components used in the project. Component list, identification method, and nomenclature to be coordinated with and approved by the Technology Designer.

C. All cross-connecting cable shall be adequately tagged as “to” and “from.”

3.7 FIELD QUALITY CONTROL

A. All ancillary accessories (e.g. remote controls, keys, etc.) shall be collected, identified by installation location, and turned over to the Owner. Coordinate delivery with Technology Designer to ensure appropriate signoffs are received.

B. The Owner and/or Technology Designer may designate an agent who may be present during testing and may provide additional testing to verify cabling installer results. The agent shall accept or reject the installation.

3.8 DEMONSTRATION AND STARTUP

A. All training and demonstration will be provided at no cost to the District.

B. Additional training requirements are listed in individual specification sections.

3.9 DOCUMENTATION

A. For multi-phase projects, adequate documentation for completed work shall be submitted as each phase is completed to allow the owner and project team to utilize the system.

B. Provide progressive “as-builts” to the Owner as devices are installed, including MAC address, serial number information, and specific installed location. Provide this information to the Owner daily as necessary, through a collaborative software (ex. Google Sheets, or Office365) and format approved by the Owner and Technology Designer. Handwritten notes will not be accepted.

C. At the conclusion of the project (or major phase for multi-phase projects), all documentation is to be compiled into an organized, comprehensive package. Copies are to be submitted both in hard copy and electronic formats. CAD drawings shall be in AutoCAD or Revit format. The Contractor is responsible for any fees charged by the architect for providing CAD backgrounds.

D. Contractor responsible for all equipment registration per manufacturer’s instructions.

E. As-Built: In addition to requirements specified in Division 1, include the following:

1. As-built drawings are to reflect all changes between the bid documents and the final installation, including final location of all equipment, outlets, racks, penetrations, etc. inclusive of the base bid, implementation add/changes, and all change orders.

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2. Drawings for systems showing location and cabinet/enclosure layout. Include all components identifying component manufacturer and model, serial numbers, and connections.
3. Cable tests, OTDR traces, etc. are to be provided in both hardcopy format as well as electronic format. Any software necessary to view the tests must be provided to the Owner.
4. Wiring and systems certification.
5. Certificate of manufacturer's extended warranty, where applicable.
6. Spreadsheet identifying system components, installed location, model number, serial number, label designation, warranty expiration, and any other project-specific pertinent data. Spreadsheet format to be approved by Technology Designer.
7. Schematics shall be created in AutoCAD or Visio format. Handwritten drawings shall be accepted for draft or working copies only.
8. Drawings with floorplans shall be created in AutoCAD or Revit format. Handwritten drawings shall be accepted for draft or working copies only.
9. All as-built and other closeout documentation to be submitted as a PDF in addition to the native file format.

F. Maintenance Data:

1. Detailed operating instructions covering operation under both normal and abnormal conditions.
2. Routine maintenance procedures for system operation, customized for the installation.
3. Lists of spare parts and replacement components recommended being stored at the site.

END OF SECTION 27 0000

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SECTION 27 1000 – GENERAL CABLING REQUIREMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 General Technology Requirements
2. Any specification sections that include cabling and/or cabling installation.

1.2 SUMMARY

A. This Section includes general cabling requirements for contractors installing cabling within their scope of work.

B. Contractor is required to furnish and install cables and accessories in locations as shown on plan drawings, details, and specifications.

C. Scope of work includes all physical cable management hardware, including, but not limited to backboards, cable supports, raceway, and cable management required to complete the system.

D. Where adequate pathways are not provided by the electrical contractor, each Contractor is required to provide their own penetrations, sleeves, and cores with firestopping. Sleeves and cores shall have nylon bushings. Contractors are to control dust generated from penetrations, protect nearby equipment and surfaces from dust, and follow all OSHA regulations.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. All cable types
2. Terminations components for each system
3. Faceplates

B. Shop Drawings:

1. Include all labeling schemes for all systems such as station outlets, cable runs, patch panels, punchdown blocks, racks, etc.

C. Samples:

1. Sample outlet including faceplate, modules, and labeling.

D. Qualification Data:

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1. Include written confirmation from the manufacturer that the bidder is a certified installer for the structured cable plant solution.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Contractor must be certified by the manufacturer of the solution being installed.

B. Installation Supervision: Installation and testing shall be performed by BICSI Registered Installers or manufacturer certified installers, with a consistent supervisor who shall be present at all times when work of this section is performed.

C. Comply with all requirements of the 2017 NEC unless jurisdiction requires a different version. Cables must comply with temperature rating requirements including Table 725.144.

D. Comply with EIA/TIA 568B-2.1, EIA/TIA 569, and EIA/TIA 606.

1.5 COORDINATION

A. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

B. All Contractors utilizing a shared pathway shall be responsible for coordinating and ensuring that firestopping requirements are fulfilled. Any unused penetrations installed by the electrical contractor for future use shall be firestopped by the data cabling contractor.

C. All Contractors utilizing penetrations shall be present during electrical and fire marshal inspections with adequate firestopping material and shall immediately correct any issues identified during the inspections.

D. Each Contractor is to protect their own cables during installation. Rough cables are to be properly supported and not left on the floor. If conditions necessitate leaving cables Contractor is to put a note on the cables to reduce chance of damage by others and note cable location to controlling contractor.

E. Each Contractor to protect their cables in areas where ceilings will be painted to ensure cable sheath is not painted.

F. For projects where the structured cabling for access points, video surveillance cameras, etc. is being provided by a different contractor, the Contractor installing the equipment (access point, video surveillance camera, etc.) will be responsible for coordinating the cable locations with the structured cabling contractor. In general:

1. Equipment contractor is to extend the cable to the final equipment mounting location including penetrations, firestopping, waterproofing, raceway, etc. Equipment contractor to provide longer patch cables if needed to reach the mounted equipment location.

2. For areas where equipment will be mounted in accessible ceiling, cabling contractor is to run the cable to the center of the space for wireless access points or the general area where video surveillance cameras or other equipment are shown. Coil adequate cable to reasonably relocate the equipment within the space.

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3. For outdoor equipment, stairwells, equipment in open ceiling spaces to be mounted adjacent to accessible the accessible ceiling in an adjacent space (corridor, etc.) cabling contractor is to run the cable to the adjacent interior space. Equipment contractor is to create the penetration and extend cable to final equipment location, and seal the penetration as required for weatherproofing or firestopping.

4. For open ceiling areas where cabling will be routed away from the adjacent accessible ceiling (e.g. along the perimeter of the space or along the beams/trusses and dropped down to the equipment location in a gymnasium, natatorium, atrium, etc.), the cabling contractor is to run the cable near/above the equipment location. Equipment contractor is to extend cable to final equipment location.

1.6 WARRANTY

A. The contractor warrants the system to be free of defects of workmanship or products and will inspect and repair the system during the warranty period at no additional cost to the Owner. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law

B. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

C. The data and voice structured cable plant shall be covered by the manufacturer's extended warranty (eg. Panduit Certification Plus System Warranty, Hubbell Premise Wiring Mission Critical Warranty and System Performance Guarantee, etc.).

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Coordinate the features of materials and equipment so they form an integrated system complying with TIA/EIA-568B. Match components and interconnections for optimum future performance.

B. The Contractor is to use plenum rated cabling and accessories throughout the project. All cables shall be continuous and free from splices.

2.2 FACEPLATES, CONDUIT, AND SURFACE-MOUNTED RACEWAYS

A. These general requirements apply to all contractor(s) unless more specific information is included in a particular contractor's specification sections (i.e. structured cabling, audiovisual cabling, etc.).

B. Where the data and audio/video contractor(s) will be sharing a faceplate, the video contractor is to provide the faceplate and any required blank modules. The faceplate must be able to accept

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the termination jack chosen by the data cabling contractor. Contractors shall coordinate all faceplate and termination requirements.

C. Coordinate faceplate requirements with the furniture installer, where applicable.

D. Each contractor shall provide and install blank faceplates / insert on any outlets provided by the electrical contractor for their potential technology use (video outlets, security outlets, data/voice general purpose telecommunication outlets, etc.).

E. Faceplate labels shall be secured to the faceplate (loose or removable labels on the screw covers are not permanent and not acceptable).

F. Each Contractor is responsible for all surface-mounted raceways and conduit for cabling not provided by the electrical contractor. Common potential locations requiring conduit for cables are described below:

1. Conduit for security cameras, wireless access points, audiovisual components, or general communications outlets installed outdoor or in large open spaces without drop ceilings (i.e. gymnasium, cafeteria).
2. Security cabling for access control systems and intrusion detection systems in vestibules, entrances, doorways, or other areas where cabling cannot be concealed.
3. Other public spaces where cabling cannot be concealed, and contractor could have reasonably known they existed.
4. In all other instances requiring surface-mounted raceways that the contractor could not have reasonably known about from construction coordination drawings (e.g. ceiling plans) or pre-bid walkthroughs made available to the contractor whether or not they participated, unit pricing will be utilized. Approval must be obtained prior to installation.

G. The following are general guidelines for raceways:

1. Surface-mounted raceway shall not be used unless the wall or other structure cannot be fished and cut into. Contractor to obtain approval prior to installing surface-mounted raceway in areas not already indicated on the drawings.
2. Surface-mounted raceways shall be sized appropriately for each installation following all manufacturers' guidelines.
3. Steel raceway (e.g. Legrand/Wiremold) shall be used in classroom and office areas. EMT conduit may be used in lieu of steel raceways in gymnasiums or other similar spaces and only after approval is received.
4. All surface-mounted raceways shall be steel construction (e.g. Legrand/Wiremold V700, V4000, etc.).
5. All steel raceways shall be ivory.

H. The following are general guidelines for faceplates:

1. For recessed boxes and surface-mounted faceplates, data faceplates shall be stainless steel with module frames or decora inserts. A/V faceplates may be plastic if necessary to provide the required A/V inserts.
2. Where single-channel surface-mounted raceway and boxes are used, faceplates shall match the raceway color.
3. Where dual-channel surface-mounted raceway is used (e.g. Legrand/Wiremold V4000), faceplate shall match the faceplates used in the existing installation.
4. Plastic faceplates are to be used where necessary to coordinate and match modular furniture systems.

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5. Blank faceplates are to be stainless steel. Blank inserts for dual-channel raceway shall match the faceplate type and color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Review building plans and installations to confirm outlet and conduit installation and location. Check outlets, conduits, raceways, cable trays, and other elements in the proposed pathways for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation in compliance with manufacturer requirements.

C. Contractors are to examine existing telecommunication rooms, equipment, cabinets, racks, etc. to ensure the conditions will not interfere with their installation. Contractors will be responsible for moving existing items where possible to allow for their installation (e.g. shifting patch panels, wire management, and equipment within a rack or cabinet; moving items on a backboard, etc. to make room for the new installation). If the rework requires re-ordering the existing items or removing wire management, review the layout with the Technology Designer and Owner.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether such items are specifically mentioned in the plans and specifications.

B. The Contractor shall be familiar with the site and the rooms to ensure a proper installation. The final installation methods are left to the discretion of the contractor in accordance with this specification, manufacturer's specifications, and within standards of generally accepted workmanship.

C. Contractor shall be familiar and install in accordance with all applicable codes and standards, including FCC, NEC (NFPA 70), EIA/TIA 568, 569 and 606, BICSI (Telecommunications Distribution Methods Manual, Current Edition), federal, state, and local building/fire codes.

D. All cable above the ceiling must be independently and properly supported to the building structure with hangers or cable tray independent from the ceiling grid or other support systems (e.g. cables shall not be run through trusses). Each contractor will provide all supports necessary for their work.

1. Separate supports are to be used for each type of cabling runs (e.g. data, fiber, video, PA, security, etc.).
2. Cable supports (e.g. J-Hooks) shall be wide enough to maintain required cable bend radius and to avoid pinch points on the corners of the support.
3. All cable hangers/supports shall be no more than 60" apart.
4. Each cable bundle shall include a maximum of 192 cables.

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5. Special care will be taken to avoid damage to ceiling grid, ceiling tiles, or other installed work. Cable “draped” across ceiling tiles is unacceptable.

E. Ensure all cables within cable trays are arranged to avoid individual cables supporting the weight of the cable bundle. Cable trays shall have appropriate bend radii for cable and fiber. Provide elbows, supports, and ties to assist in offloading the weight of the cable and adequately support the tray.

F. Support riser cables every floor and at the top of the run with cable grips. Limit number of four-pair data riser cables per grip to fifty (50).

G. Fiber optic cable shall be plenum rated armored cable.

H. Fill rates for all cable supports must not exceed the lesser of 50 percent, or as recommended by the manufacturer(s).

I. All wiring shall be protected from moving mechanical or physical contacts. All cabling shall be free from tension at both ends, as well as the length of each run.

J. Cables to be kept a minimum of 18” from power lines, fluorescent fixtures, or heat generating devices. All cross-connecting cable shall meet or exceed the transmission characteristics for the cable used in the adjoining segments.

K. All cabling shall be bundled and properly secured and terminated in the telecommunication room cabinet. Cables must be properly supported and separated to avoid crushing or cinching by supports, protective covers, doors, etc. All cables within wire management cabinets will be cable wrapped with Velcro cable ties at no greater than one-foot intervals. Velcro tie-wraps only are to be used.

L. For general communications outlets, Contractor to provide additional 10' of cabling coiled above nearest accessible ceiling at each drop and 10’ of cable at each telecommunication room. Unless noted otherwise, specialized systems (i.e. security and wireless) shall have 20’ of cable coiled above the ceiling at each drop and 10’ of cable at each telecommunication room. The additional lengths of cable shall be included in distance calculations. Cable routing within the telecommunication closet is to be approved by the Technology Designer before beginning termination.

M. In general, adhesives and non-mechanical fastening methods of installation will not be accepted. All conduit, cable and raceway installation support must be mechanically fastened to walls, decks, slab, structure, etc.

N. Install parallel to building lines, follow surface contours, and support the cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.

O. All horizontal cabling terminations shall be provided with sufficient additional cabling to permit re-termination within the cabinet. The additional lengths of cable shall be included in distance calculations. Service loops shall be irregularly coiled to avoid electromagnetic or antenna effects.

P. All connections of twisted wiring shall be made in such a way as to minimize the extent in which each twisted pair is unraveled at the point of its physical termination. No more than 0.5 inches of exposed untwisted pairs shall be present at these locations.

Q. Provide sufficient pulling lubrication for all underground cable pulls. Do not exceed the manufacturers tension requirements for any installation.

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R. Exposed wiring will not be accepted unless approved in writing by the Technology Designer. Cabling shall be in the wall, above the ceiling, or in conduit (or raceways if approved by Technology Designer) designed for the application. A difficult installation will not be sufficient to avoid the requirement for non-exposed wiring.

1. Contractor to install conduit in exposed areas along cable pathway. Raceway can be used for the vertical segment transitioning to the outlet location (e.g. from ceiling space down wall to outlet). Conduit in exposed areas are to be painted to match surrounding conduits/ceiling color.
2. Exposed wiring will be acceptable in crawl spaces.
3. Exposed wiring will be acceptable in high bay gymnasiums if the cables are run along a joist and hidden from view. Cables must be concealed from the wall to the joist.
4. No exposed cabling will be allowed in natatoriums.
5. No exposed cabling will be allowed in architecturally significant spaces, such as a media center or entrance lobby.
6. In instances greater than 15’ requiring conduit that the contractor could not have reasonably known about from available drawings (e.g. ceiling plans) or pre-bid walkthroughs made available to the contractor whether or not they participated, the contractor may request reimbursement for the installation. Approval must be obtained prior to installation.

S. In unheated crawl spaces, contractor is to install the cable at least four feet (4’) from the exterior wall mounted securely to the slab or structure.

3.3 UNDERGROUND INSTALLATION

A. Prior to beginning any underground work, Contractor shall contact MISS DIG, local utility survey staff, and utility companies for the location of all existing underground services and provide, if requested, documentation of such contact to Barton Malow Company. If necessary, Contractor shall pay for appropriate layout and locating of all existing utilities, and stake said utilities.

B. Utilities and/or other services which are shown, or not shown but encountered, shall be protected by the Contractor from any damage arising or resulting from work, unless or until they are abandoned. If the utilities or services are damaged from Contractor’s work, Contractor shall notify the Technology Designer immediately. Contractor shall repair any damage and restore the utilities and services to an equal or better condition than that which existed prior to the damage within four (4) hours. If the Contractor does not repair the work or the Owner or Barton Malow considers the damage unresolved in a timely manner, repairs will be made at Contractor expense.

C. Contractor shall provide and maintain proper shoring and bracing during its excavation, to protect from collapse or movement, or other type of damage until such time as they are to be removed, incorporated into the new Work or can be properly backfilled upon completion of the work and inspections.

D. Contractor shall photograph and document the environment immediately before beginning work, upon exposing any utilities, and after work and/or repair is completed. Barton Malow shall review the work and/or repairs before any work is buried.

E. Contractor will be responsible for all liabilities, damages, expenses, lawsuits or claims arising or resulting from such damage and will defend, hold harmless and indemnify Owner and Barton Malow from any claims or lawsuits or other expenses.

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3.4 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606.

B. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors. All rack fields, devices, components, etc. shall be tagged with appropriate designations on the front and rear of the equipment. All devices are to be installed and labeled in a sequential, logical order.

C. Adhesive labels shall meet the legibility, defacement, and adhesion requirements specified in UL969 for indoor use. Cable labels shall have a durable substrate, such as vinyl, suitable for wrapping. Labeling practices shall be consistent across the installation.

D. Cable runs shall be machine labeled within 1” of each termination. All cabling and fiber optics are to be tagged in a consistent manner, approved by the Technology Designer.

E. Fiber Optic Safety Installation. Label all fiber optic junction boxes and termination points with "fiber-optic cable - lasers in-use - possible eye injury" warnings inside and outside of the location.

F. At junction boxes, label with a description of the cable, termination location, and strand count.

3.5 FIELD QUALITY CONTROL

A. Contractor will provide cabling acceptance testing. Agent of owner may provide additional testing and cable acceptance. Contractor is responsible for correcting any instances of test failures.

B. Indicate and interpret test results for compliance with performance requirements of installed systems. All test results shall be marked as “Pass” or “Fail”.

C. All test results must be provided in both hard copy and electronic format.

D. Contractor is responsible for correcting any instances of marginal test results or test failures.

3.6 DOCUMENTATION

A. As-Built Documentation:

1. Include scaled drawings reflecting all changes between the bid documents and the final installation, including final location of all telecommunication rooms, equipment, cable paths, outlets, etc.
2. Drawings shall include all cable routing, outlet locations, and outlet labels.
3. Drawings shall be created in AutoCAD or Revit format. Handwritten drawings shall be accepted for draft or working copies only.

END OF SECTION 27 1000

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SECTION 27 1116 – RACKS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements

1.2 SUMMARY

A. This section includes specifications and requirements for racks and cabinets to be used throughout the technology project.

B. Refer to appropriate drawings and specification sections for cabinet types, quantities, and locations.

C. Server cabinets shall be provided by the Owner, installed by the structured cabling contractor.

1.3 DEFINITIONS

A. For general requirements the term “cabinet” refers to cabinets, relay racks, etc.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Cabinet or Rack
2. Wire Management
3. Cabinet Accessories

B. Shop Drawings: Include dimensioned plan and elevation views of telecommunications equipment rooms, with each individual component labeled. Show cabinet assemblies, workspace requirements, and access requirements.

1.5 COORDINATION

A. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

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B. The cabling contractor will provide cabinets and racks in telecommunication rooms. The A/V contractor will provide the cabinets associated with the A/V systems. The Owner and/or other technology contractors will utilize these cabinets for their installation and adequate space is to be factored into the cabinet layouts (Owner-furnished source equipment, security equipment, fiber optic WAN, public address, master clock, etc.).

C. Coordinate telecommunication room and cabinet layouts with related contractors.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. All materials shall be installed with matching color and quality to ensure a high-quality finished installation. Unless noted otherwise or approved in writing by Technology Designer, all materials shall have a black finish.

B. All lockable cabinets are to be keyed alike. Contractor to coordinate keying with Technology Designer.

C. For each cabinet or rack section:

1. Provide one rack mounted surge suppression outlet power strip and/or vertical power strip as appropriate.
2. Provide rack-grounding termination.

2.2 RACKS

A. General Requirements:

1. Racks shall be 4-post, high-grade black anodized-aluminum with front and back standard 19” EIA mounting screw holes.
2. Minimum height 84".
3. Contractor will provide 6” wide, duct-style vertical wiring management with removable protective covers on both sides of each rack.

B. Manufacturer:

1. Hubbell
2. Ortronics
3. Panduit
4. Approved Equal

2.3 WALL MOUNTED CABINET

A. General Requirements:

1. Cabinets are to be a minimum of 24” wide and 48” high (unless noted otherwise on drawings), black painted steel, with final depth confirmed with verification of equipment size and front cabling requirements. Assume 30” deep for pricing if depth is unknown at bid time.
2. Lockable scratch-resistant tinted glass front door and standard rear door.

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3. Cabinet enclosures shall be field-reversible (Left or Right) hinged
4. Entire unit shall swing at each door to permit front and rear equipment and cabling access.
5. All cables running to the cabinet will be installed in either raceway or conduit.

B. Manufacturer:

1. Hoffman Accessplus II or EWMW
2. Approved equivalent

2.4 RACK AND CABINET COMPONENTS

A. Power Strip / PDU

1. Manufacturer standard nine (9) minimum outlet or greater receptacle strip rated at 20A minimum with surge suppression plug, and circuit breaker. Contractor to supply proper power strip for voltage supplied
2. Unit shall be provided with rack bolting.

B. Cable Ties

1. Cable ties shall be plenum rated.
2. Cabinet and rack ties shall be Velcro-type ties

2.5 SPARES

A. Provide spare of the following spare equipment and/or parts

1. Provide one (1) box of mounting bolts or screws for each type of cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether such items are specifically mentioned in the plans and specifications.

B. The Contractor shall be familiar with the site and the rooms to ensure a proper installation. The final installation methods are left to the discretion of the contractor in accordance with this specification, manufacturer's specifications, and within standards of generally accepted workmanship.

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C. The contractor shall protect equipment and components during installation and clean all equipment before owner acceptance using methods and materials recommended by the manufacturer.

D. All units shall be aligned and perpendicular to adjacent walls.

E. Racks and cabinets are to be properly installed and secured to handle equipment load. The racks shall be bolted to floor, cable tray, and/or wall for added rigidity. Adjacent cabinets shall be bolted together at the top and bottom at both the front and rear of the units.

F. Provide independent circuit grounding recommended by manufacturer. Grounding is to be consistent with ANSI/TIA/EIA 607 and NEC requirements as a minimum. Each contractor to connect their cabinets to a single-point ground which is connected to the building ground system via #6 AWG green insulted copper grounding conductor.

G. Contractor to adjust side mounting rails to optimize front and rear cabinet clearances. No less than three inches of clearance must be provided between the equipment and the cabinet door for cabling.

H. Equipment Mounting Positions (From Top):

1. WAN fiber panel (where applicable)
2. LAN fiber panel
3. Alternating patch panels and switches
4. Power Strip
5. UPS
6. Verify phone gateway, master clock system, PA, etc. location if mounted in cabinets

END OF SECTION 27 1116

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SECTION 27 1300 – BACKBONE AND OUTDOOR CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 1116 – Racks and Cabinets
4. 27 1500 – Data and Voice Horizontal Cabling

1.2 SUMMARY

A. Extent of the cabling systems work is indicated by the drawings and schedules, and is hereby defined to include, but not by of limitation, the provisions of:

1. Backbone cables between the telecommunication rooms.
2. Indoor/outdoor station cabling
3. Campus backbone cabling between buildings.
4. All termination blocks, outlets/jacks, patch panels, patch cords, etc.
5. Termination, cross connect, and patching.

B. The data cabling infrastructure shall compliant with EIA/TIA standards under T568B-2.1. Campus voice, fiber optic, data and video infrastructure shall be implemented compliant with applicable standards.

C. Data cables shall be routed so as not to exceed 90 meters in length. Notify the Technology Designer before bid period question deadline, established at the pre-bid meeting, should any changes in bid documents be required to conform to this limitation. After entering into Contract, Contractor shall provide Technology Designer-approved solution to meet the 90-meter requirement without additional expense to the Owner.

D. Provide coordination and installation in accordance with standards, rules, regulations and requirements of utilities, ROW owners, state, county, cities, villages, townships, municipalities, and any other authority having jurisdiction.

1.3 DEFINITIONS

A. AHJ: Authority Having Jurisdiction

B. ER: Equipment Room

C. HH: Handhole

D. MC: Main Cross-connect [Applies to references to MDF]

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E. MMF: Multimode fiber

F. SMF: Single-mode fiber

G. TR: Telecommunication Rooms [Applies to references to IDF]

H. TP: Transition point

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Cable
2. Terminations (Patch panels, punchdown blocks, etc.)

B. Samples:

1. Proposed labeling format.

C. Qualification Data:

1. Include written confirmation from the manufacturer that the bidder is a certified installer for the cable plant solution.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have on-staff personnel certified by the cable solution manufacturer.

B. Installation Supervision: Installation and testing shall be performed by BICSI Registered Installers or manufacturer certified installers, with a consistent supervisor who shall be present at all times when work of this section is performed.

1.6 COORDINATION

A. Coordinate cables installed in this section with the Owner and phone, data, security, network, etc. contractors whose equipment will be using the cabling.

1.7 WARRANTY

A. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. The cable plant shall be covered by the manufacturer's warranty (eg. Panduit Certification Plus System Warranty, Hubbell Premise Wiring Mission Critical Warranty and System Performance Guarantee, etc.).

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PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Coordinate the features of materials and equipment so they form an integrated system complying with TIA/EIA standards. Match components and interconnections for optimum future performance.

B. Contractor is to use plenum rated cable and cabling accessories throughout this installation.

2.2 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Any deviations must be approved in writing by the Technology Designer before installation.

1. Indoor/Outdoor UTP Voice/Data Cable
   a. Berk-Tek
   b. Belden
   c. Commscope
   d. General
   e. Hitachi
   f. Lucent
   g. Mohawk
   h. Superior Essex
2. Fiber Optic Cable
   a. Berk-Tek
   b. Belden
   c. Commscope
   d. Draka Comteq
   e. General
   f. Legrand Infinium Quantum
   g. Lucent
   h. Siecor
   i. Tyco
3. Patch Panels, Faceplates, Station Terminations, Jacks, other Accessories
   a. Cable manufacturer
   b. Hubbell
   c. Panduit

2.3 INDOOR/OUTDOOR DATA STATION CABLING

A. Cable Standards:

1. Cable is to be continuous, Category 6 compliant UTP cable rated for indoor and outdoor underground in-duct installations.
2. Plenum-rated required when cabling indoors extend beyond 50’ from the building entry location.
3. Cable shall have an UV-resistant sheath and a core of solid-copper conductors, dual insulated with foam skin and plastic, surrounded by a gel-filling compound.

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4. Cabling shall be certified as a complete system with other components required herein to achieve manufacturer's cabling system extended warranty.

B. Manufacturer:

1. Hitachi Cable Drybit Category 6 Indoor-Outdoor Cable
2. Approved equivalent

C. Termination standards:

1. Contractor shall install lightning protectors in telecommunication room for each data/voice cable.
2. Terminate at station location in "biscuit box" in nearest accessible ceiling or as recommended by station equipment manufacturer/installer.

2.4 FIBER OPTIC CABLING BACKBONE

A. Cable Standards:

1. Indoor backbone cable is to be continuous, armored, plenum-rated, tight-buffered multimode fiber optic cable.
   a. In lieu of armored cable, contractor can request to provide innerduct for the entire cable pathway. Fiber optic cable shall be installed in orange, plenum-rated innerduct. Maximum fill is 40%.
2. Outdoor backbone cable is to be continuous, single armored dry buffer, loose-tube ITU G.652D single-mode fiber optic cable rated for aerial and underground applications.
   a. Any facilities in which the termination point is greater than 50' from the location the fiber enters the building will be fusion spliced to plenum rated cable in a wall-mounted fiber optic splice enclosure. Utilize indoor fiber optic standards for the remaining portion of the work modifying applicable language for single-mode installations to reflect cable type and yellow sheathing.
3. Each fiber must be individually jacketed.
4. Call shall have EIA/TIA -598 color coding for fiber optic cable.
5. All multi-mode fiber is to be OM4. Use single mode fiber for distances exceeding 500m and all outdoor applications.
6. All pig tails and patch cables are to match the type of fiber optic cable installed.
7. All fiber is to be fusion spliced; no field terminations or mechanical splices will be accepted.
8. Indoor cable sheath and accessories are to follow the following color designation:

a.	OM3	Aqua
b.	OM4	Violet
c.	Singlemode	Yellow

B. Termination Standards:

1. Provide 19" rack mounted (sized as necessary, 72-port maximum) optical fiber termination panels with cable strain relief and slack storage. Provide breakout and storage of 5' of cable. Size the patch panel for an additional space for 12 future terminations.
2. LC terminations are to be used, or as required by the equipment manufacturer.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Contractor shall be familiar and install in accordance with all applicable codes and standards, including FCC, NEC (NFPA 70), EIA/TIA 568, 569 and 606, BICSI (Customer-Owned Outside Plant Design Manual, current edition), BICSI (Telecommunications Distribution Methods Manual, current edition), federal, state, and local building/fire codes.

B. Installation must be in accordance with applicable utility company standards.

C. Contractor to follow the applicable grounding and bonding requirements.

D. Contractor to provide additional cabling coiled above ceiling at both the workstation locations and in telecommunication rooms. The additional lengths of cable shall be included in distance calculations. Cable routing within the telecommunication closet is to be approved by the Owner's Representative before beginning termination.

E. Fiber optic cables shall be marked with warning labels every twenty feet (20').

3.3 UNDERGROUND INSTALLATIOIN AND BUILDING ENTRANCE REQUIREMENTS

A. Prior to beginning any underground work, Contractor shall contact MISS DIG, local utility survey staff, and utility companies for the location of all existing underground services and provide, if requested, documentation of such contact to the CM. If necessary, Contractor shall pay for appropriate layout and locating of all existing utilities, and stake said utilities.

B. Contractor to install new underground pathway and conduit between the building(s) and outdoor equipment location.

C. Provide conduit and sealed junction box at all exterior wall penetrations designed to maintain the required bend radii. All entrances into the building will be properly water and fire stopped. Penetrations through exterior walls will be core or drilled hole, and finished with adequate seal and weatherproofing. Chiseling of bricks or portions of bricks is not acceptable. Filling penetrations with expanding foam insulation is not acceptable.

D. Provide a minimum 2" conduit (or as shown on the drawings) with material appropriate to the installation. All joints shall be cleaned, coupled, connected, and sealed to prevent infiltration of water.

E. Provide and install a trace wire in each underground segment.

F. Provide underground handholes where required. The top of the handhole shall be stamped or etched "Communication" or manufacturer's equivalent. Install the handholes with ¼ inch of the

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final ground level, at a distance of no greater than 300' apart. Handholes shall also be installed whenever the combination of elbows and bends totals greater that 180 degrees. Handhole sizes shall be based on NEC Article 314.16 and Article 315.28; however larger than 4'x4'x4' shall not be used without written approval.

G. Contractor may utilize a directional bore or trench to install the conduit. Conduits to be installed to a minimum of 36" below grade. Installation shall follow OSHA requirements.

H. Compact all backfilled materials and level site. Restore remainder of topsoil for grass installations and re-sod restored excavation. Any concrete or asphalt damage shall be restored. Backfill excavation and trenches with compacted sand to 1' below grade and provide warning tape. Restore remainder of topsoil for grass installations. Compact crushed stone/sand for concrete/asphalt installations and restore to original condition.

I. Any installation in a public right of way, easement, or public roadways or other property not owned by the Owner shall be restored in accordance with property owners' or governing agency regulations and requirements. If no regulations govern, as a minimum restore to a condition similar to pre-installation quality.

J. Utilities and/or other services which are identified, or not identified but encountered, shall be protected by the Contractor from any damage arising or resulting from work, unless or until they are abandoned. If the utilities or services are damaged from Contractor's work, Contractor shall notify the Technology Designer immediately. Contractor shall repair any damage and restore the utilities and services to an equal or better condition than that which existed prior to the damage within four (4) hours. If the Contractor does not repair the work or the Owner or Barton Malow considers the damage unresolved in a timely manner, repairs will be made at Contractor expense.

1. Contractor shall photograph and document the environment immediately before beginning work, upon exposing any utilities, and after work and/or repair is completed. Barton Malow shall review the work and/or repairs before any work is buried.
2. Contractor will be responsible for all liabilities, damages, expenses, lawsuits or claims arising or resulting from such damage and will defend, hold harmless and indemnify Owner, Barton Malow Builders, c2ae, and Christman Construction from any claims or law suits or other expenses.

K. Contractor shall provide and maintain proper shoring and bracing during its excavation, to protect from collapse or movement, or other type of damage until such time as they are to be removed, incorporated into the new Work or can be properly backfilled upon completion of the work and inspections.

L. Unless specifically noted on the drawings as a direct-buried installation, underground installations shall be in conduit.

3.4 HANDHOLE REQUIREMENTS

A. Provide underground handholes as needed to facilitate the installation and future servicing of the backbone cables.

B. Provide Quazite underground handhole enclosures rated to 15,000 lbs.

C. The top of the handhole shall be stamped or etched "Fiber Optic Cabling" or manufacturer's equivalent.

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D. Install the handholes at final ground level, at a distance of no greater than 1,000' apart. Handholes shall also be installed whenever the combination of elbows and bends totals greater that 180 degrees.

E. Handhole sizes shall be based on NEC Article 314.16 and Article 315.28; however larger than 2'x2'x2' shall not be used without written approval.

F. Conduits are to sweep up through the bottom of the handhole with the handhole bottom filled with gravel.

G. Install a ground rod in each vault or handhole and connect to wire electrode.

3.5 INSIDE CABLE INSTALLATION

A. Contractor is to follow the requirements established in section 27 1000.

B. If the termination location is greater than 50' from the building point of entrance, or as required by applicable codes, cable will be fusion spliced to plenum rated cable in a wall-mounted fiber optic splice enclosure. Point of entrance is the point within the building where the cable emerges from an external wall, from a concrete floor slab, or from rigid metal conduit or intermediate metal conduit connected to an electrode by a grounding conductor in accordance with NEC 2014 800.100 and 800.2.

C. Due to field conditions or other situations, installation locations may have to be relocated a reasonable distance from the plan location. Unless relocations, modifications and reengineering are consistently or substantially unfavorable to either the contractor or the owner, there will be no additional charge or credit for this work.

D. The contractor shall be familiar with the site and the rooms to ensure a proper installation. The final installation methods are left to the discretion of the contractor in accordance with this specification and within standards of generally accepted workmanship.

E. If non-armored fiber is approved for use, fiber optic cable shall be installed in orange, plenum-rated innerduct. Maximum fill is 40%.

F. Ensure all cables within cable trays are arranged to avoid individual cables supporting the weight of the cable bundle. Cable trays shall have appropriate bend radii for cable and fiber. Provide elbows, supports, and ties to assist in offloading the weight of the cable and adequately support the tray.

3.6 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606-A

B. The cable run shall be machine labeled or legibly hand labeled with indelible ink within 1" of termination. Final termination at the distribution frame is also to be appropriately tagged. All cabling and fiber optics are to be tagged in a consistent manner.

C. Fiber Optic Safety Installation. Label all fiber optic junction boxes and termination points with "fiber-optic cable - lasers in-use - possible eye injury" warnings inside and outside of the location.

D. At junction boxes, label with a description of the cable, termination location, and strand count.

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3.7 FIELD QUALITY CONTROL

A. The UTP installation is to be tested to the current EIA/TIA TSB Channel Performance Testing Standard, or equivalent as approved by the Technology Designer.

1. Cables are to be tested with a Fluke OmniScanner2, or equivalent by Agilent or Wavetek, using the correct software version and adapter for the cable installation or as required for manufacturers warranty program.
2. Cables are to be tested consistently with the tester in the MC, and the injector at the remote TR.

B. Document for each pair as well as the worst margin the following test results:

1. Cable identification (Building and Circuit ID)
2. Test date
3. Cable length (ft.)
4. Wiremap
5. Delay (ns)
6. Skew (ns)
7. Resistance (Ohms)
8. Attenuation
9. NEXT
10. ELFEXT
11. Return Loss
12. PSNEXT
13. PSELFEXT

C. Optical Time Domain Reflectometer (OTDR) testing is required on all terminated fiber optic cables. The operator of the test equipment must be properly trained and have experience in the operation of this equipment and interpreting and certifying test results. While preterminated, factory-certified cables may be installed; the contractor must provide a field verifiable method of determining attenuation, continuity, bandwidth, etc. Contractor is to provide an OTDR test of each fiber spool before installation to verify fiber is not damaged upon delivery.

D. Any cables that do not meet the minimum performance criteria established by the standards or manufacturer shall be corrected or replaced at no additional cost to the Owner. If the copper backbone cable contains more than one (1) percent bad pairs, remove and replace entire cable.

3.8 DEMONSTRATION

A. Contractor shall train the Owner on the layout of the backbone cabling system including the pathways, termination methods, and interconnections.

3.9 DOCUMENTATION

A. As-Built Documentation:

1. Include scaled drawings documenting the final installation, including final location of all telecommunication rooms, cable paths, etc.
2. Drawings shall be created in AutoCAD or Revit format. Hand written drawings shall be accepted for draft or working copies only.
3. Include photographs of the completed fiber splice trays for each telecommunication closet location.

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B. Cable Testing

1. Cable test results are to be provided electronically (PDFs) organized by building and telecommunication room.
2. Contractor is to review fiber/OTDR test results with Owner and annotate a sample test result indicating key indicators.

C. Underground Conduit Labeling

1. For each underground conduit used, Contractor is to label both ends of the **conduit** identifying where the conduit runs (e.g. “Fiber to Press Box”)

D. Warranty

1. Provide certificate of manufacturer’s extended warranty for the cabling system.

END OF SECTION 27 1300

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SECTION 27 1500 – DATA HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 1116 – Racks and Cabinets
4. 27 1300 – Backbone Cabling

1.2 SUMMARY

A. This Section includes general cabling requirements for contractors installing structured data or voice cabling within their scope of work.

B. The cabling infrastructure shall be implemented as a data solution compliant with EIA/TIA standards under T568B-2.1. Fiber optic, security, and audiovisual infrastructure shall be implemented compliant with applicable standards.

C. Extent of the cabling systems work is indicated by the drawings and schedules, and is hereby defined to include, but not by of limitation, the provisions of:

1. Horizontal cables to the telecommunication rooms.
2. All termination blocks, outlets/jacks, patch panels, patch cords, etc.
3. Termination, cross connect, and patching.

D. Data cables shall be routed so as not to exceed 90 meters in length. Notify the Technology Designer before bid period question deadline, established at the pre-bid meeting, should any changes in bid documents be required to conform to this limitation. After entering Contract, Contractor shall provide Technology Designer-approved solution to meet the 90-meter requirement without additional expense to the Owner.

E. Color Coding:

1. The following chart describes the cable type/color for the primary structured cabling systems defined in this spec section.

System	Cable Type	Distributio n Cable	Patch Cable (Station)	Patch Cable (Closet)	Jack Color
Data	CAT 6	Blue	Black	Blue	Orange
Analog	CAT 6	Grey	N/A	Grey	Grey
Wireless	CAT 6A	Yellow	N/A	Orange	Yellow
Security	CAT 6	Green	N/A	Green	Green
Audiovisual	CAT 6	Black	Black	Black	Black

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F. Patching:

1. This Contractor is responsible for patching to all switches. Switches will be provided, by others, equal to the number of data ports. Provide **Category 6** patch cables. Quantity shall match the total number of data cables installed.

2. Patch cables shall be the minimum lengths necessary to patch one-for-one while utilizing the wire management. Technology Designer to approve patching method before installation.

3. Do NOT patch unused patch panel ports.

4. Patch cables shall NOT have boots

5. Patch cable manufacturer shall be consistent with the patch panel and jack manufacturer.

G. Contractor shall provide and install horizontal cable tray in each telecommunication room. Unless noted otherwise, cable tray will start at the edge of the room where incoming cables are fed, provide cable support for all racks, and be secured to the walls.

1.3 DEFINITIONS

A. ER: Equipment Room

B. MC: Main Cross-connect [Applies to references to MDF]

C. TR: Telecommunication Rooms [Applies to references to IDF]

D. PoE: Power over Ethernet

1.4 SUBMITTALS

A. Prior to ordering, confirm colors of horizontal cables, patch cables, and jacks.

B. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Cable
2. Faceplates
3. Terminations (Patch panels, jacks, etc.)
4. Patch cables (Identify lengths, colors, and quantities)

C. Samples:

1. Faceplate with proposed labeling format.

D. Qualification Data:

1. Include written confirmation from the manufacturer that the bidder is a certified installer for the cable plant solution.

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1.5 QUALITY ASSURANCE

A. Installer Qualifications: Contractor must be certified by the manufacturer of the solution being installed.

B. Layout Responsibility: Preparation of Shop Drawings by an RCDD.

C. Installation Supervision: Installation and testing shall be performed by BICSI Registered Installers or manufacturer certified installers, with a consistent supervisor who shall always be present when work of this section is performed.

D. Comply with EIA/TIA 568B-2.1, EIA/TIA 569, and EIA/TIA 606.

1.6 COORDINATION

A. Coordinate cables for door entry, video surveillance, wireless infrastructure, etc. with the contractor who will be installing the equipment for termination location and method.

1.7 WARRANTY

A. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. The cable plant shall be covered by the manufacturer's warranty for a minimum of fifteen (15) years (e.g. Panduit Certification Plus System Warranty, Hubbell Premise Wiring Mission Critical Warranty and System Performance Guarantee, etc.).

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Coordinate the features of materials and equipment so they form an integrated system complying with TIA/EIA-568-B. Match components and interconnections for optimum future performance.

B. One manufacturer must be used for all termination jacks, patch panels, and patch cables.

C. Contractor is to use plenum rated cable and cabling accessories throughout this project.

D. All Category 6A cables will be UL limited power (LP) rated.

2.2 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Any deviations must be approved in writing by the Technology Designer before installation.

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1. Voice and Data Cable
   a. Berk-Tek
   b. Belden
   c. Commscope
   d. General
   e. Liberty Wire & Cable
   f. Lucent
   g. Mohawk
   h. Superior Essex
   i. Approved Equal
2. Patch Panels, Faceplates, Station Terminations, Jacks, other Accessories
   a. Hubbell
   b. Panduit
   c. Approved Equal

2.3 DATA CABLE AND TERMINATIONS

A. Cable Standards:

1. Cabling shall be contiguous, plenum rated **Category 6/6A**, four-pair UTP cable compliant with EIA/TIA 568B-2.1 standards.
2. Cable shall be solid copper.
3. Cabling shall be certified as a complete system with other components required herein to achieve manufacturers cabling system extended warranty.

B. Termination Standards:

1. Terminations shall be **Category 6/6A** compliant modular, T568B RJ-45 jacks.
2. Video surveillance, wireless access point, or other equipment terminations shall be modular T568B RJ-45 jacks in a plenum-rated biscuit box located in the nearest accessible ceiling or junction box to the end device. Alternatively contractor can use a modular plug terminated link (i.e. direct connect) that meets the ANSI/TIA-568-C.2 clause 6.3 requirements. If a modular plug terminated link (MPTL) is used, testing must be performed with the appropriate channel adapter.

2.4 INDOOR/OUTDOOR DATA STATION CABLING

A. Cable Standards:

1. Cable is to be continuous, Category 6/6A (6A for wireless) compliant UTP cable rated for indoor and outdoor installations between two environmentally protected points, including underground pathways.
2. Use in areas with thermal or chemical exposure.
3. Plenum-rated required when cabling indoors extend beyond 50’ from the building entry location.
4. Cable shall have an UV-resistant sheath and a core of solid-copper conductors, dual insulated resistant to chemical, moisture, and thermal exposure.
5. Cabling shall be certified as a complete system with other components required herein to achieve manufacturer’s cabling system extended warranty.

B. Manufacturer:

1. Hitachi Cable Drybit Indoor-Outdoor Cable
2. Super Essex with FEP Jacket CMP Indoor/Outdoor

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3. Approved equivalent

C. Termination standards:

1. Contractor shall install lightning protectors in telecommunication room for each data/voice cable.
2. Terminate at station location in “biscuit box” or as recommended by station equipment manufacturer.

2.5 PATCH PANEL DISTRIBUTION FRAME TERMINATIONS

A. Standards:

1. Patch panels must be Category 6/6A, 19”, 48-port patch panels with T568B terminations.
2. Provide patch panels for all cables installed plus eight (8) open ports in each telecommunication room for future use.
3. Patch panels shall have a rear strain relief bar to organize cables and maintain appropriate bend radius.
4. Data cables shall be terminated sequentially. If terminated on the patch panels, cables installed for building systems (fire alarm phone line, security phone line, pay phones, etc.) shall be terminated together in the last patch panel positions and its use labeled on the patch panel.

2.6 FACEPLATES AND MODULE FRAMES

A. Faceplates shall be sized to accommodate the raceway, back box, or floorbox for each location with adequate modules for the required jacks.

B. All faceplates shall be Decora style stainless steel. Utilize smooth metal 302/304 stainless steel for all faceplates. Blank plates shall be sized to fit box without Decora cutout.

1. Exception: Plastic module frames shall be used where necessary to match installation of other contractors.

C. Faceplate labels shall be secured to the faceplate (loose or removable labels on the screw covers are not permanent and not acceptable).

2.7 CABLE TRAY

A. General Requirements:

1. Contractor may utilize cable tray or ladder rack.
2. Cable tray shall have a black finish to match cabinets within each telecommunication room.

B. Size:

1. Cable tray shall be sized so that there is no more than 30% fill at the completion of the project.
2. Provide 12” wide minimum in intermediate telecommunication rooms.
3. Provide 18” wide minimum in the main telecommunication room.

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C. Cable tray supports shall be adequately sized to accommodate a minimum of 5 times the weight of the maximum cable fill and tray plus 300 lbs. and as per the manufacturer's recommendations.

2.8 PATCH CABLES

A. Provide Category 6 8-conductor patch cables for use within telecommunication rooms. Provide one for every data cable installed throughout the project. Patch cables shall be the minimum lengths necessary to patch while utilizing the wire management. Technology Designer to approve patching method. Refer to the cable color chart.

B. In addition to the patch cables to be used in the telecommunication rooms, provide Category 6 8-conductor patch cables for the owner's use at the station end in the following lengths and colors. Provide one for every data cable installed throughout the project.

Min. Length	Color	Quantity
6 ft	blue	40%
15 ft	**black**	40%
20 ft	blue	20%

C. Patch cable manufacturer shall be consistent with the patch panel and jack manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Review all closet layouts with Technology Designer prior to installation.

B. With cables being visible in spots, the Owner has said they will not accept installations that do not meet their expectations for a neat installation. Where possible in open ceiling areas with exposed ceilings, contractors are to conceal cables in trusses, use J-hooks where necessary, etc.

C. Contractor shall be familiar and install in accordance with all applicable codes and standards, including FCC, NEC (NFPA 70), EIA/TIA 568, 569 and 606, BICSI (Telecommunications Distribution Methods Manual, current edition), federal, state, and local building/fire codes.

D. Contractor shall limit cable bundles for cable runs, cables in telecommunication rooms, and penetrations to:

1. Cat 5e 52 cables
2. Cat 6 64 cables
3. Cat 6A 74 cables

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E. Contractor to provide additional cabling coiled above ceiling at both the workstation locations and in telecommunication rooms. The additional lengths of cable shall be included in distance calculations. Cable routing within the telecommunication closet is to be approved by the Owner's Representative before beginning termination.

F. At station locations, terminate all 8 conductors on all jacks, regardless of data or telephone use.

G. Ensure all cables within cable trays are arranged to avoid individual cables supporting the weight of the cable bundle. Cable trays shall have appropriate bend radii for cable and fiber. Provide elbows, supports, and ties to assist in offloading the weight of the cable and adequately support the tray.

H. Service loops for Cat 6A cables are to be installed in an S-configuration and not a circular loop.

3.3 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606-A.

B. Each termination module shall be labeled with a white, wrap-around self-adhesive label. Use Panduit MINI-COM® Module Port Identification Self-Adhesive Labels, or equivalent.

C. Each label shall identify the telecommunication room, patch panel and patch panel port. For example: 1-A-34 would refer TR-1, patch panel A, port 34.

D. Data cable patch panels shall be labeled sequentially with letter designations A, B, C, etc.

E. Patch panel ports used for mounted devices (wireless access points, surveillance cameras, displays, etc.) will be labeled with the device name (e.g. AP-09 for access point 9, CAM-07 for surveillance camera 7, etc.).

F. In addition to the faceplate label, each cable is to be labeled behind the faceplate and patch panel with a machine generated wrap-around self-adhesive label that matches the port label on the patch panel and faceplate.

G. Each rack is to be labeled with the IDF/MDF designation (e.g. IDF-1, IDF-2) utilizing permanent adhesive labels. Labels shall be at least 2" high and should be located in the lower right-hand corner of the backboard.

3.4 FIELD QUALITY CONTROL

A. The installations must be tested and certified as compliant for Category 6/6A Gigabit connectivity. The installation is to be tested to the current EIA/TIA TSB Channel Performance Testing Standard, or equivalent as approved by the Technology Designer. For workstation locations without a patch cable, use a 10' cable at for testing purposes.

1. Cables are to be tested with a Fluke Versiv Cable Certifier, or equivalent by Agilent or Wavetek, using the correct software version and adapter for the cable installation or as required for manufacturers warranty program.
2. Cables are to be tested consistently with the tester in the telecommunication room, and the injector at the workstation termination locations.
3. Testing will be performed after faceplates have been secured to the raceway/wall/floorbox.

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B. Document for each pair as well as the worst margin the following test results:

1. Cable identification (Building and Circuit ID)
2. Test date
3. Cable length (ft.)
4. Wiremap
5. Delay (ns)
6. Skew (ns)
7. Resistance (Ohms)
8. Attenuation
9. NEXT
10. ELFEXT
11. Return Loss
12. PSNEXT
13. PSELFEXT

C. Any cables that do not meet the minimum performance criteria established by the standards or manufacturer shall be corrected or replaced at no additional cost to the Owner.

3.5 DOCUMENTATION

A. As-Built Documentation:

1. Include scaled drawings reflecting the final installation, including final location of all telecommunication rooms, equipment, cable paths, outlets, etc.
2. Drawings shall include all cable routing, outlet locations, and outlet labels.
3. Provide pictures of all cabinets where equipment, patch panel, and labeling is visible.
4. Drawings shall be created in AutoCAD or Revit format. Handwritten drawings shall be accepted for draft or working copies only.

B. Cable Testing

1. Cable test results are to be provided in hard copy format as well as a PDF organized by building and telecommunication room.

C. Warranty

1. Provide certificate of manufacturer's extended warranty for the structured cabling system.

END OF SECTION 27 1500

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SECTION 27 4000 – GENERAL A/V SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 1116 – Racks and Cabinets

1.2 SUMMARY

A. This Section includes general requirements for any contractor performing the following AV work:

1. Gym audio system
2. Cafeteria audiovisual system

1.3 SYSTEM REQUIREMENTS - GENERAL

A. All faceplates shall be stainless steel with silkscreen labels. Confirm labels prior to production.

B. All A/V cabling shall be professional grade and sized appropriately for each installation. If signal degradation occurs as the result of cable selection/installation, it will be replaced at no additional cost to the owner.

C. All A/V connectors shall be professional grade. If signal degradation occurs as the result of connector selection/termination, it will be replaced and re-terminated at no additional cost to the owner.

D. The contractor is responsible for providing any signal amplification necessary to ensure a completely functional and professional installation whether such items are specifically mentioned in the plans or specifications.

E. The contractor is responsible for all patch cables required to ensure a completely functional and professional, turn-key solution.

F. A/V schematics, plans, details, etc. are for conceptual purposes only. Final design to be provided by contractor and approved by Technology Designer. Notify the Technology Designer before bid period question deadline, established at the pre-bid meeting, should any changes in bid documents be required to meet the design concept. After entering the Contract, Contractor shall provide a Technology Designer-approved solution to meet design concept.

G. Equipment that extends more than 4” from the wall will be mounted above 80” above finished floor unless reviewed and approved by Technology Designer or Owner.

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1.4 DEFINITIONS

A. **CEC:** Consumer Electronics Control

B. **CVBS:** Composite Video, Blanking, and Sync

C. **EDID:** Extended Display Identification Data

D. **HDCP:** High-Bandwidth Digital Content Protection

E. **KSV:** Commonly called an HDCP 'key'. A unique ID for each HDMI sink that must be sent to HDCP-enabled sources for the sinks to receive content.

F. **Source:** AV equipment connected to the inputs of the AV switching system

G. **Sink:** AV equipment connected to the outputs of the AV switching system (i.e. displays, audio processors)

H. **Video Timing:** a combination of resolution and refresh rate (i.e. 1920x1080@60)

1.5 SUBMITTALS

A. Product Data: For each type of product purposed, provide the manufacturer's product data sheet in both hard-copy and electronic (PDF) formats including dimensions and data on features, performance, electrical characteristics, ratings, and finishes. Data sheets indicating multiple products must have the applicable product highlighted or marked.

B. Additional Data: For all mounting hardware and accessories, provide manufacturer's recommendations for all mounting methods and materials. Include locations for each type of mount used in the project.

C. Preliminary A/V Schematics

1. General Requirements:

   a. Submit in both hard-copy (11 X 17 or half size prints) and electronic (Visio or AutoCAD 2008 or higher) formats.
   b. Label all devices with manufacturer part name and number. A supplementary spreadsheet with device information may be submitted in lieu of labeling every component in the schematic.
   c. Show all Inputs/Outputs for every component. Mark unused inputs/outputs as "spare."
   d. Show connector types for all terminations.

2. Required Schematics:

   a. Audio flow for each system
   b. Video flow for each system
   c. Control flow
   d. Mounting methods (dimensioned)
   e. Faceplate layouts

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1.6 COORDINATION

A. The contractor is responsible for coordination with electricians as needed, structured cabling contractors as needed and attending job site meetings.

1.7 WARRANTY

A. The contractor warrants the system to be free of defects of workmanship or products and will inspect and repair the system within twenty-four (24) hours during the warranty period at no additional cost to the Owner. The Contractor shall respond on site within four (4) hours notice, and without cost to the Owner, during this warranty period. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law

B. All equipment shall be provided with a **minimum three (3) year warranty** unless noted otherwise. The warranty period shall begin at the date indicated on the certificate of substantial completion or the date of Owner acceptance (to be received in writing and approved by Barton Malow), whichever comes later.

C. The contractors' installation warranty on all AV systems shall be **three (3) year** from the time of installation acceptance as approved by the Technology Consultant and the Owner.

D. The warranty shall include phone support, software assurance, firmware updates, and any other special warranties.

E. The Owner shall not be responsible for additional charges during the installation warranty period. Labor, service charges, trip charges, etc. to configure and install equipment during the warranty period shall be included in the contractor's warranty.

F. The contractor is to provide documentation for all manufacturer's warranties including the operating conditions required for the warranty.

G. The contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. Laser projector and electric screen with Sound Systems

2.2 AV CABLES

A. General Requirements

1. HDMI cables and adapters are to be hi-speed HDMI cables Certified to pass complete EDID information

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2. Throughput of at least 10.2 Gbps and designed for 4k@60Hz
3. Patch cables for user equipment are to be rated by manufacturer as “flexible” (example: Kramer C-MHM/MHM series).
4. Provide strain relief as necessary or as recommended by manufacturer for utilized cable distance.
5. Distances:
   a. For distances up to 35’ use a 24AWG HDMI cable (patch cables <15’ can be 26 AWG)
   b. For distances >35’ use a HDMI Fiber cable or an active Cat 6 HDMI extender.

B. Manufacturers:

1. Covid USA
2. Crestron
3. Extron
4. Kramer
5. Liberty Wire & Cable
6. Monoprice Cabernet Series
7. Approved Equal

2.3 AUDIO VIDEO SWITCHING

A. General Requirements

1. The AV switching system shall support at least 6.75Gbps of data transfer on each input and output to support 1080p 36-bit (Deep) Color video resolutions without compression.
2. The AV switching system shall support 8 channel audio.
3. The AV switching system shall support audio breakaway from video.
4. The AV switching system shall have less than 5us of latency from AV input to AV output.
5. The AV switching system shall downmix multi-channel audio into 2-channel audio so that the same audio content may be routed to both multi-channel and 2-channel sinks.
6. The AV switching system shall be able to dither between standard and deep color video signals on each input and output.
7. The AV switching system shall support the following AV signal inputs:

   a. HDMI 1.3a

B. The AV switching system shall transcode the AV signals to a single signal type for distribution.

2.4 AUDIO VIDEO DISTRIBUTION

A. General Requirements

1. The AV distribution system shall use multimode fiber or shielded twisted pair for AV signal distribution.
2. The AV distribution system shall route AV signals from any input to any output with less than 1ms of latency.
3. The twisted pair structured cabling used to carry the AV signals shall be shielded.
4. The twisted pair structured cabling used to carry the AV signals shall be specified to 1.2GHz of bandwidth or greater.

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2.5 EDID MANAGEMENT

A. General Requirements

1. The AV switching system shall allow configuration of the EDID presented to sources on each AV input.
2. Each input on the AV switching system shall be configured independently.
3. The AV switching system shall by default present an EDID to each input that includes only the video timings and audio formats common all sinks connected to the outputs.

2.6 HDCP MANAGEMENT

A. General Requirements

1. The AV switching system shall support HDCP 2.3 or greater.
2. The AV switching system shall detect the number of KSVs supported by each source.
3. The AV switching system shall not send a source more KSVs than it supports.
4. The AV switching system shall cache the KSVs from each connected sink.
5. The AV switching system shall authenticate all cached KSVs with each source up to the source's KSV limit, so that authentication does not need to be re-started each time content is routed to a new output.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review mounting locations before installation. Coordinate locations with the electrical, mechanical, and architectural contractors and mitigate conflicts with other devices and boards.

B. Coordinate mounting height/locations with existing conditions and mount to avoid covering existing devices or devices to be installed during construction.

C. The contractor shall notify Construction Manager and Technology Designer of any conflicts before installation.

3.2 INSTALLATION

A. Install all components according to manufacturer's guidelines. Provide raceway as required for the installation to conceal cables.

B. Provide wire management and cable wrap to manage and conceal cables between the wall and source. Submit cable wrap color for approval prior to installation.

C. Install safety cable for all ceiling-mounted equipment. Safety cable shall be connected to building steel and must be independent of any ceiling grid or accessories.

3.3 DOCUMENTATION

A. As-Built Documentation:

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1. Spreadsheet by building identifying installed components, location (architectural room number and owner's room number), model number, serial number, and any other pertinent data. Spreadsheet format to be approved by Technology Designer. For network-enabled projectors, include the MAC address and IP address.
2. The number of HDCP KSVs Keys supported by each source
3. The video timing, HDCP use and audio format of each source when operating.
4. The video timings and supported audio formats for each connected sink
5. The video timings and supported audio formats presented in the EDID to each source – the preferred video timing shall be indicated.
6. Schematic diagram indicating equipment and interconnections.

    a. Audio flow for each system
    b. Video flow for each system
    c. Control flow for each system
    d. Rack layouts

7. Contractor to turn over electronic version of source code for all control system programming. Provide both compiled and un-complied code.

B. Manufacturer's Instructions: Provide complete installation, set-up and maintenance instructions.

END OF SECTION 27 4000

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SECTION 27 4116 – CLASSROOM AV SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 5116 – Public Address System

1.2 SUMMARY

A. This Section includes general requirements for:

1. Interactive displays and soundfield amplification systems. Contractor to provide all equipment, materials, mounts, cabling, etc. for complete systems.

2. The soundfield amplification system will be used as the public address system in the classrooms. Refer to the public address system specification section for requirements for non-classroom spaces (corridors, offices, etc.).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, provide the manufacturer's product data sheet in electronic (PDF) format including dimensions and data on features, performance, electrical characteristics, ratings, and finishes. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Interactive flat panel display.
2. Cable and connectors.
3. Mounts.
4. Mobile carts.
5. Sound-field amplification system.

B. Samples

1. Provide a sample end-to-end classroom HDMI/USB solution including patch cables, faceplates, and connectors for the Owner to test with their equipment.

1.4 QUALITY ASSURANCE

A. Audio Enhancement EPIC System must be provided by an authorized EPIC reseller, and installed by Audio Enhancement EPIC Level II Certified installer.

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B. Clevertouch display must be provided by an authorized Clevertouch reseller, and the lead installer must be a Clevertouch Certified Engineer or Installer.

C. AV schematics, plans, details, etc. are for conceptual purposes only. Final design to be provided by contractor and approved by Technology Designer. Notify the Technology Designer before bid period question deadline established at the pre-bid meeting should any changes in the bid documents be required to meet the design concept. Once bids have been received, contractor will be responsible for providing a solution approved by the Technology Designer for meeting the design concept.

D. All AV cabling shall be professional grade and sized appropriately for each installation. If signal degradation or image issues occur as the result of cable or adapter selection/installation, it will be replaced at no additional cost to the owner.

E. All AV connectors shall be professional grade. If signal degradation or image issues occurs or as the result of connector selection/termination, it will be replaced and re-terminated at no additional cost to the owner.

F. Contractor is responsible for providing any signal amplification and transmission necessary to ensure a completely functional and professional installation whether or not such items are specifically mentioned in the plans or specifications.

G. Contractor is responsible for all patch cables required to ensure a completely functional and professional, turn-key solution.

PART 2 - PRODUCTS

2.1 INTERACTIVE FLAT PANEL DISPLAY

A. General Requirements:

1. Model: 75” Clevertouch Impact 2 unless size is noted differently on drawings
2. Warranty: Minimum 5 years
3. MDM: Minimum 5 years license (Radix or Manufacturer’s equivalent)
4. Connectivity: HDMI and USB to the teacher’s computer
5. Accessories: Five (5) spare of each accessory that come with each display (e.g. stylus, eraser, etc.)
   Include a cleaning cloth with each display
6. The unit will be mounted to facilitate cleaning and maintenance

B. In addition to the remaining specifications, contract, and manufacturer’s requirements Contractor is responsible for the following:

1. Mount the display and ancillary equipment to facilitate cleaning and maintenance while concealing cabling and equipment that are mounted behind the display.
2. Provide appropriate wall bracing where needed.
3. Use black cable wrap to conceal any visible cables either from the front or side of the display.
4. Provide 10’ audiovisual patch cables for each display unless noted otherwise on the drawings. Provide black mesh cable wrap for AV cables and integrate data cable or other cables provided by others into the cable wrap.
5. Where shown on drawings provide proper over the board bracket and wire management to properly secure and support the unit and associated installation.

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6. Contractor to work with Owner to create a master display with customized display settings, district-standard apps, user settings, etc. Contractor to then setup all boards similarly.
7. All displays are to be installed with sources connected consistently. For example, if the instructor's computer is connected to HDMI 1 in the prototype rooms then HDMI 1 is to be used for the remaining instructor's computer connections.
8. Contractor will ensure display is on the network, named according to the district standard, enrolled in the management solution, with the latest or approved software version installed on each display.
9. Contractor is to connect display to the instructor's computer and ensure both video and USB are functioning correctly.
10. After reviewing standard classroom accessories the Owner and Technology Designer, Contractor should anticipate gathering, organizing, and delivering some accessories to the Owner in a central location, while leaving other accessories secured to the display.
11. At the completion of each room installation, Contractor is to provide photos of each installation including:
    a. Display with the Android module shown on the display
    b. Display connected to the instructor's computer, with the room number written using the display interactivity
    c. Photo of the inputs showing consistent input usage
    d. Photo of the side of the display showing the mount and cable management.

C. Software:

1. Built-in screen mirroring from Chrome, iOS, Mac OS, Windows, and Android.
2. Minimum 5 years MDM license (Radix or Manufacturer's equivalent)
3. Management software that includes as a minimum:
    a. Maintain and inventory of equipment by location, name, serial number, and software version. Group displays by building.
    b. Change device settings remotely
    c. Remotely shut down or restart individual displays or groups of displays
    d. Install apps
    e. Remotely update Android and device firmware
4. Standard software included with the equipment purchase.
5. For any software requiring licensing, include 5 years of licensing as part of base bid allowing the software to be used by all staff and students.

D. Installation Height:

1. Install so the bottom of the display screen at it's lowest position (for height adjustable mounts) is 23" aff.

E. Base Bid Manufacturers:

1. Clevertouch Impact 2

Manufacturer Contact Info:
Jack Willson, VP Clevertouch USA
jack.willson@clevertouch.com

2.2 HEIGHT ADJUSTABLE WALL MOUNT

A. General Requirements

1. Provide ability for users to raise and lower the display manually without any tools.
2. Include any accessories, extension arms, etc. required for the display.

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3. Vertical shift: Minimum 15.5” with ability to remain secure in any vertical position
4. Load capacity: Rated for the weight of the display, ancillary AV equipment, plus 50 lbs.
5. Motorized: No
6. Contractor is to adjust for ease of operation, and for leveling the display.

B. Acceptable Manufacturers

1. Display manufacturer
2. Balance Box
3. Chief Fusion Dynamic
4. Peerles

2.3 MOBILE FLAT PANEL DISPLAY CART

A. General Requirements

1. Screen Size Compatibility: 65” – 86”
2. Weight Capacity: Weight of the display plus 100 lbs.
3. Color: Black power coat finish
4. Mounting Pattern Compatibility: match interactive display
5. Orientation: Landscape
6. Height Adjustable: No
7. Locking casters: Yes (minimum 2 locking)
8. Center of Display to Floor/Table Range: 50 – 70”
9. Computer Shelf: No
10. Power Strip: Provide electrical outlet strip with cord wrap
11. Cord Management: Provide cord wrap for HDMI and USB cables
12. Contractor to place fluorescent tape on the top of the cart legs.

B. Manufacturers

1. Peerless SR598
2. Copernicus
3. Approved equivalent

2.4 HDMI EXTENDERS

A. Two options are given below. Contractor can submit the solution they are comfortable supporting throughout the warranty period.

B. Whichever option is selected, Contractor must provide a sample end-to-end solution including patch cables, faceplates, and connectors for the Owner to test with their equipment.

2.5 HDMI/USB EXTENDER (Option 1)

A. General Requirements

1. Provide HDMI and USB extenders to connect the interactive flat panel display to the instructor’s computer.
2. Format: Decora Wall-plate at teacher desk and a direct connection to the interactive display.
3. Cable: Active Optical HDMI cable

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4. HDMI: HDBaseT 4K@60Hz 4:4:4
5. USB: as required for the connected equipment
6. Instructor faceplate will have one HDMI and one USB input

B. Manufacturers:

1. Kramer CP-AOCH/60
2. Approved equivalent

2.6 HDMI/USB EXTENDER (Option 2)

A. General Requirements

1. Provide HDMI and USB extenders to connect the interactive flat panel display to the instructor's computer.
2. Format: Decora Wall-plate at teacher desk with receiver mounted behind interactive display.
3. HDMI: HDBaseT 4K@60Hz. HDCP compliance
4. USB: as required for the connected equipment
5. Instructor faceplate will have one HDMI and one USB input
6. Contractor will use plenum, shielded, pre-terminated (not field terminated), **black** Category 6 cabling for the connection between transmitter and receiver unless the manufacturer recommends using a different cable (e.g. non-shielded cable or Cat 6A cable, etc.).
7. Terminate the cable in a biscuit box secured behind the display.
8. Contractor is to modify the existing raceway/outlet or supply a surface mounted back box where necessary for the installation.
9. Mount the receiver in a serviceable location behind the display, yet concealed from audience view. Where possible, locate on the side of the display furthest from the door. Utilize cable management or cable wrap to conceal the remaining cables.

B. Manufacturers:

1. Audio Enhancement
2. Crestron
3. Extron
4. Hall Research
5. Kramer
6. Liberty

2.7 SOUND-FIELD AMPLIFICATION

A. Standard Classroom System

1. Audio Enhancement Optimum System with Integrated XD Receiver
2. Audio Enhancement MS-600 amplifier/receiver
3. Audio Enhancement WBA-601 with ambient microphone
4. One (1) teacher microphone and charger. Microphone to have an emergency and call button.
5. One (1) handheld student wireless microphone and charger
6. (4) classroom speakers appropriate to the ceiling type
7. MS-600 auxiliary input connected to the interactive display's audio out port thru the in-wall conduits.
8. Minimum 3-year manufacturer's warranty

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B. Accessories to include in the base bid:

1. Include five (5) additional teacher microphones.
2. Include five (5) handheld student wireless microphones in the base bid

C. Manufacturers:

1. Audio Enhancement EPIC/Optimum — Manufacturer Contact Info:
   Alex North
   alex.north@audioenhancement.com
   (574) 298-4880
2. Other manufacturers can be submitted as a voluntary alternate

2.8 CEILING SPEAKERS

A. In rooms with accessible suspended ceiling tiles speakers shall be recessed-mounted with white grilles.

B. In classrooms with open ceilings provide white WS-09 wall speakers and mount horizontally from the roof beams. Review prototype installation with the Owner, CM or Barton Malow before proceeding.

C. In rooms with open ceilings with no roof beams provide white WS-09 wall speakers and mount to the walls or roof structure as appropriate.

2.9 AV CABLES

A. HDMI cables and adapters are to be hi-speed HDMI cables meeting or exceeding the following:

1. Contractor is to test the cables with the Owner's equipment and must demonstrate a 4K image at 50Hz or higher.
2. Certified to pass complete EDID information
3. Throughput of at least 18 Gbps and designed for 4K@60 4:4:4.
4. Patch cables for user equipment are to be rated by manufacturer as "flexible".
5. Provide strain relief as necessary or as recommended by manufacturer for utilized cable distance.
6. Distances:
   a. For distances up to 25' use a 24AWG HDMI cable (patch cables <15' can be 26 AWG)
   b. For distances >25' use an active Cat 6 HDMI extender or active fiber HDMI cables.

B. Manufactures:

a. Comprehensive AV/IT Series
b. Crestron
c. Extron
d. Kramer

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2.10 FACEPLATES AND MODULE FRAMES

A. Faceplates shall be sized to accommodate the raceway, back box, or floorbox for each location with adequate modules for the required jacks.

B. The following are general guidelines for faceplates:

1. For recessed boxes and surface-mounted faceplates, data faceplates shall be stainless steel with module frames or decora inserts. A/V faceplates may be plastic if necessary to provide the required A/V inserts.
2. Where single-channel surface-mounted raceway and boxes are used, faceplates shall match the raceway color.
3. Where dual-channel surface-mounted raceway is used (e.g. Wiremold V4000), faceplate shall match the faceplates used in the existing installation.
4. Plastic faceplates are to be used where necessary to coordinate and match modular furniture systems.
5. Blank faceplates shall be stainless steel.
6. Blank inserts for dual-channel raceway shall match the faceplate type and color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review mounting locations before installation. Coordinate locations with the electrical, mechanical, and architectural contractors and mitigate conflicts with other devices and boards.

B. Coordinate mounting height/locations with existing conditions and mount to avoid covering existing devices or devices to be installed during construction.

C. Contractor shall notify Technology Designer of any conflicts before installation.

3.2 MATERIAL HANDLING

A. Contractor shall have a representative onsite to receive delivery of Owner-furnished equipment and verify equipment quantities. Any quantity deviations or items damaged on delivery shall be noted to the Owner in writing immediately following delivery.

B. Contractor shall sign for all equipment that will be installed under their contract and shall be responsible for the equipment until the complete room systems are substantially complete and transferred to the Owner. Contractor will be responsible for coordinating replacement equipment for any items non-functioning upon delivery, and will replace any equipment missing or damaged during installation.

C. Contractor will be responsible for storing equipment until the equipment can be installed. Owner may be able to provide space in a central location for a portion of the Contractor's equipment. Contractor is responsible for transporting the equipment between the storage space and the individual buildings.

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D. Contractor is responsible for any equipment stored on premise. The Owner shall not be responsible for theft or damage to any equipment prior to Owner's acceptance of equipment after it is fully installed and operational.

E. Contractor is responsible to remove packing materials and general debris from the site. The Owner's trash cans and dumpsters are not to be use used except for minor debris cleanup. Contractor is responsible for arranging dumpster drop off and pickup if they choose to use a dumpster as opposed to removing the materials from the site. Any dumpster locations and delivery/pickup times are to be coordinated with the Owner to avoid conflicts with parking, activities, or student drop off / pick up times.

3.3 INSTALLATION

A. Contractor shall choose appropriate mounting method and materials for each location based on manufacturer's requirements, wall construction, building structure, etc.

B. Coordinate equipment location with electrical contractor. Location shown on drawings is approximate; contractor may shift slightly to avoid obstructions (lights, overhead mechanical, etc.) however location must accommodate the interactive display and marker boards.

C. Equipment that extends more than 4" from the wall will be mounted a minimum of 80" above finished floor unless reviewed and approved by Technology Designer or Owner.

D. Install all components according to manufacturer's guidelines. Provide raceway as required for the installation to conceal cables.

E. Provide wire management and cable wrap to manage and conceal cables between the wall and source. Submit cable wrap color for approval prior to installation.

F. Amplifiers or other electronics that have AC line voltage power requirements can not be mounted above the ceiling.

G. Install safety cable for all ceiling equipment supported by the building steel.

H. Contractor is to register all equipment on behalf of the Owner.

3.4 DEMONSTRATION / COMMISSIONING

A. Contractor will setup a prototype classroom with all of the cabling, equipment, and connectors found in a typical classroom. Contractor will demonstrate functionality to the Owner and Technology Designer prior to installing the remaining spaces.

1. The prototype classroom will be setup in time to allow the Owner to test additional equipment in the space.
2. If the construction schedule does not allow a prototype to be setup in a classroom, contractor will utilize all cabling, equipment, and connectors to setup a prototype of the connectivity in a separate space for approval of components. Contractor will still review a typical physical installation before completing all spaces.

B. Demonstration:
1. Contractor to provide one 2-hour overview of the equipment for the pilot classroom teachers.

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2. Contractor to provide one 1-hour overview for the classroom soundfield system. This training will occur after the Owner moves into the building.
3. Contractor to provide training on the Epic system as requested by the administration and office staff.

3.5 AS-BUILT DOCUMENTATION

A. Provide spreadsheet by building identifying installed components for the interactive displays and soundfield systems. Spreadsheet format to be approved by Technology Designer. Include:

1. Location (architectural room number and owner's room number)
2. Manufacturer and model name
3. Model number
4. Display size
5. Serial number (display and Android module)
6. IP address and MAC address for networkable equipment
7. Other pertinent data for the specific equipment.

B. Provide schematic diagram of final AV systems reflecting any changes approved during implementation. Include:

1. Audio flow for each system
2. Video flow for each system

C. Provide complete manufacturer's installation, set-up and maintenance instructions.

D. Provide evidence that all equipment has been registered with the manufacturer on behalf of the owner.

3.6 SPARES

A. Repeated from sections above

1. Five (5) teacher microphones
2. Five (5) handheld student microphones
3. Five (5) spare of each accessory that come with each display (e.g. stylus, eraser, etc.)

END OF SECTION 27 4116

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SECTION 27 4119 –MULTIPURPOSE AV SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 270000 – General Technology Requirements
2. 271000 – General Cabling Requirements
3. 271116 – Racks and Cabinets
4. 274116 – Classroom AV Systems

1.2 SUMMARY

A. Refer to system schematic drawings.

B. General requirements for the Cafeteria AV system:

1. Provide a wall-mount system cabinet with integrated equipment rack.
2. Provide power distribution within the equipment rack for all rack-located devices. Power shall remain ON at all times to support immediate use of the system.
3. Provide rack accessories as necessary for a complete and clean installation, including but not limited to:
   a. Blank plates
   b. Cable management
   c. Thermal management (rack fans)
   d. Drawer (2U)
4. Provide a control system, inclusive of a 7” (minimum) touch screen controller (“controller”) wall-mounted on the platform, to manage and control features of the system as described herein.
5. Provide the following audio devices / connections:
   a. An audio digital signal processor (“DSP”) to manage audio signals described herein.
   b. Standard classroom soundfield amplifier (without front buttons) mounted within the space to allow for use of an XD microphone and SAFE functions. Include individual level and mute control on the controller.
   c. Two (2) wireless microphone channels to support the following microphones:
      1) Channel 1 – Handheld & Bodypack with lapel microphone
      2) Channel 2 – Handheld & Bodypack with headset microphone

      The type of microphone being used with each channel shall be selectable on the controller, triggering appropriate gain structure in the DSP.

      Each channel shall have individual level and mute control on the controller.
   d. Two (2) wired handheld microphones with 25’ cables for use at any (5) wired microphone input. Each wired microphone input shall have individual level and mute control on the controller.

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e. Bluetooth receiver located within the cafeteria with coverage of the entire space. Source selection on the controller, as well as individual level and mute control on the controller.
f. Monitor output locations, each having individual level and mute control on the controller.
g. Two (2) channel amplifier to provide power to speakers with master volume and mute control on the controller.
h. Two (2) vertical line array speakers to provide stereo sound reinforcement.
i. Public address system receiver with control signal tie to DSP that mutes local audio system during page / announcement.
j. Assisted listening system, inclusive of:
   1) Required signage
   2) Transmitter
   3) Two (2) receivers
   4) Two (2) hearing loops
   5) Two (2) earpieces

   Provide Unit pricing for additional receiver, hearing loop, and earpiece.

6. Provide the following video devices:
   a. A video matrix switcher to manage video signals (and accompanying audio / control signals where applicable) / connections as described herein. Source selection with automation (where applicable) on the controller.
      It is intended that the projector and interactive flat panel (IFP) can mirror each other (with mirroring selected on the controller) using any available source.
   b. (3) HDMI over HDBaseT transmitters for auxiliary input locations V1 & V2, and feed from the IFP display.
   c. HDMI over HDBaseT receiver for IFP display.
   d. Video projector, HDBaseT video and control.
   e. Projection screen, tensioned, motorized, wall-mounted with low voltage control. Tie screen deployment and retraction to projector ON/OFF status with override on touch screen.
   f. Interactive flat panel display, HDMI and control over HDBaseT receiver, local HDMI & USB input, owner furnished / contractor installed (OFCI) digital signage player.
      1) Refer to Classroom AV specifications for Interactive Flat Panel (IFP) requirements.
      2) Provide 86” IFP with height adjustable mount.

C. General requirements for the Gymnasium AV system:

1. Provide a wall-mount system cabinet with integrated equipment rack.
2. Provide power distribution within the equipment rack for all rack-located devices. Power shall remain ON at all times to support immediate use of the system.
3. Provide rack accessories as necessary for a complete and clean installation, including but not limited to:
   a. Blank plates
   b. Cable management
   c. Thermal management (rack fans)
   d. Drawer (3U)
4. Provide a control system, inclusive of a 7” (minimum) touch screen controller (“controller”) rack-panel-mounted in the AV cabinet, to manage and control features of the system as described herein.
5. Provide the following audio devices / connections:
   a. An audio digital signal processor (“DSP”) to manage audio signals described herein.

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b. Standard classroom soundfield amplifier (without front buttons) mounted within the space to allow for use of an XD microphone and SAFE functions. Include individual level and mute control on the controller.
c. Two (2) wireless microphone channels to support the following microphones:
   1) Channel 1 – Handheld & Bodypack with lapel microphone
   2) Channel 2 – Handheld & Bodypack with headset microphone
   The type of microphone being used with each channel shall be selectable on the controller, triggering appropriate gain structure in the DSP.
   Each channel shall have individual level and mute control on the controller.
d. Two (2) wired handheld microphones with 25' cables for use at any (5) wired microphone input. Each wired microphone input shall have individual level and mute control on the controller.
e. Auxiliary audio connections (3), each having individual level and mute control on the controller.
f. Bluetooth receiver located within the cafeteria with coverage of the entire space. Source selection on the controller, as well as individual level and mute control on the controller.
g. Monitor output locations (3), each having individual level and mute control on the controller.
h. Two (2) channel amplifier to provide power to speakers with master volume and mute control on the controller.
i. Four (4) full-range cabinet speakers to provide sound reinforcement.
j. Public address system receiver with control signal tie to DSP that mutes local audio system during page / announcement.
k. Assisted listening system, inclusive of:
   1) Required signage
   2) Transmitter
   3) Two (2) receivers
   4) Two (2) hearing loops
   5) Two (2) earpieces
   Provide Unit pricing for additional receiver, hearing loop, and earpiece.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, provide the manufacturer's product data sheet in both hard-copy and electronic (PDF) formats including dimensions and data on features, performance, electrical characteristics, ratings, and finishes. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. A/V distribution equipment (amplifier, equalizers, etc.)
2. Speakers
3. Microphones
4. Projectors, Flat Panels
5. Projection Screens
6. Control system components
7. Cable and connectors
8. Mounts and mounting accessories
9. Cable management and cable wrap including color selection

B. A/V Schematics

1. General Requirements:

   a. Label all devices with manufacturer part name and number

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b. Show all Inputs/Outputs for every component. Mark unused inputs/outputs as "spare"
c. Show connector types for all terminations

2. Required Schematics:

a. Audio flow for each system (schematic)
b. Video flow for each system (schematic)
c. Device layout and speaker coverage (plan).

1.4 QUALITY ASSURANCE

A. Installers must be certified by the manufacturer for the equipment being installed.

1.5 WARRANTY

A. The contractor warrants the system to be free of defects of workmanship or products and will inspect and repair the system within twenty-four (24) hours during the warranty period at no additional cost to the Owner. The Contractor shall respond on site within four (4) hours' notice, and without cost to the Owner, during this warranty period. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law

B. All equipment shall be provided with a **three (3) year warranty** unless noted otherwise. The warranty period shall begin at the date indicated on the certificate of substantial completion or the date of Owner acceptance (to be received in writing and approved by Barton Malow), whichever comes later.

C. The warranty shall include phone support, software assurance, firmware updates, software version upgrades, and any other special warranties.

D. The Owner shall not be responsible for additional charges during the equipment warranty period. Labor, service charges, trip charges, etc. to configure and install equipment during the warranty period shall be included in the contractor's warranty.

E. Contractor is to provide documentation for all manufacturer's warranties including the operating conditions required for the warranty.

F. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

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PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. All A/V cabling shall be professional grade and sized appropriately for each installation. If signal degradation occurs as the result of cable selection/installation, it will be replaced at no additional cost to the owner.

B. All A/V connectors shall be professional grade. If signal degradation occurs as the result of connector selection/termination, it will be replaced and re-terminated at no additional cost to the owner.

C. Contractor is responsible for providing any signal amplification necessary to ensure a completely functional and professional installation whether such items are specifically mentioned in the plans or specifications.

D. Contractor is responsible for all patch cables required to ensure a completely functional and professional, turn-key solution.

E. Contractor shall have experienced programming staff to properly configure and tune specified control, audio, and video equipment per manufacturer guidelines and equipment capabilities.

F. A/V schematics, plans, details, etc. are for conceptual purposes only. Final design to be provided by contractor and approved by Technology Designer. Notify the Technology Designer before bid period question deadline, established at the pre-bid meeting, should any changes in bid documents be required to meet the design concept. After entering the Contract, Contractor shall provide a Technology Designer-approved solution to meet design concept.

2.2 AUDIO DIGITAL SIGNAL PROCESSOR

A. Manufacturers:
1. Biamp
2. Symetrix
3. Q-SYS
4. Approved equal

2.3 WIRELESS MICROPHONES

A. General Requirements

1. Provide dual channel wireless microphone system in rack that will provide both Handheld and Lapel type wireless microphones.
2. Both units must operate simultaneously.
3. Include all rack mounting hardware and required antennas for receiver in rack. RF Output Level = 10 - 30 mW (dependent on frequency version)
4. Provide Antenna distribution as needed and required to allow a microphone to be used throughout the space for a complete system. Test the antenna location before installation, and relocate if needed after Owner uses the system in occupied spaces.
5. Provide Double AA rechargeable batteries and 110v wall charger. One minimum 4-port wall charger for every (8) batteries. One set of batteries for all mics, plus one spare set for all mics.

B. Manufacturers:

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1. Audio Technica System 10 Pro
2. Shure SLXD
3. Approved equal

2.4 WIRED HANDHELD MICROPHONE

A. General Requirements:
1. Type: Dynamic
2. Polar Pattern: Cardioid
3. Frequency Response: 50 to 15,000 Hz
4. Connector: 3-Pin Male XLR
5. Switch: Yes

B. Manufacturers:
1. Shure
2. Audio Technica

2.5 AMPLIFIER

A. General Requirements

1. Solid-state (Class D)
2. Front panel controls
3. Rated for 2 to 8 ohms in Stereo mode
4. Frequency response: 20 Hz to 20 kHz at 1W (4-Ohms)
5. Protection against shortened, open or mismatched loads, overloaded power supplies, and excessive temperature
6. Power output based on need plus 20% overhead

B. Manufacturers:
1. Biamp
2. Crestron
3. Crown
4. Extron
5. LEA Professional
6. QSC

2.6 VERTICAL LINE ARRAY SPEAKERS

A. General Requirements

1. Constant Beamwidth 2-way line array speaker
2. Switchable vertical pattern coverage 45 degrees wide to 25 degrees narrow
3. Frequency Range: Within minus 10 dB from 60 to 20,000 Hz.
4. Nominal Impedance: 8-Ohm
5. Power capacity: 500w (2000W peak) 2hrs; 350w (1400W peak) 100hrs
6. System Sensitivity 2.83V @1m; 92dB to 98dB (narrow to broad)
7. JBL CBT 70J-1 or approved equal

B. Manufacturers

1. Electro-Voice
2. JBL
3. TOA

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2.7 CABINET SPEAKERS (Gymnasium)

A. General Requirements

1. 3-way
2. 120 x 110 degree HF coverage
3. Frequency Range: 38-17kHz
4. Nominal Impedance: 4-Ohm
5. Power capacity: 500W Continuous
6. JBL Control 30 or approved equal

B. Manufacturers

1. Electro-Voice
2. JBL
3. TOA

2.8 VIDEO MATRIX SWITCHER

A. General Requirements

1. HDMI input(s) and output(s)
2. HDBaseT input(s) and output(s)
3. Stereo audio output
4. Compatible HDBaseT transmitters and receivers with in-wall (wall plate) and surface-mount form factors
5. Capable of powering remote HDBaseT transmitters and receivers
6. Capable of routing video, audio, and control signals over HDBaseT
7. Capable of routing up-to Progressive 4K UHD (3840x2160) at 30Hz, 4:2:2
8. IP controllability for source and destination selection; ability to route any input to any or all inputs simultaneously without loss

B. Manufacturers

1. Crestron
2. Extron
3. Atlona
4. Approved Equal

2.9 BLUETOOTH RECEIVER

A. General Requirements

1. Wall mounted receiver
2. Pairing button with LED status indicator
3. Decora format for a single-gang box
4. Stainless steel faceplate
5. Bluetooth 5.0
6. Stereo audio
7. Provide associated receiver

B. Installation

1. Contractor to provide all cabling, installation, and configuration
2. Install with polycarbonate protective cover

C. Manufacturers

1. Crestron

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2. Extron
3. Radio Design Labs
4. Symetrix
5. Approved Equal

2.10 PROJECTOR

A. Epson EB-PU2113W with ELPLW08 lens or approved equal.

2.11 PROJECTOR MOUNT

A. Manufacturers
1. Chief
2. Peerless

2.12 PROJECTION SCREEN (MOTORIZED)

A. Da-Lite Tensioned Cosmopolitan model 70262L or approved equal.

2.13 AV CABINET (WALL)

A. Middle Atlantic DWR series or approved equal.
1. Include rear rack rail
2. Include fans
3. Include accessories as described herein

2.14 AV CABLES

A. General Requirements

1. HDMI cables and adapters are to be hi-speed HDMI cables Certified to pass complete EDID information
2. Throughput of at least 10.2 Gbps and designed for 4k@60Hz
3. Patch cables for user equipment are to be rated by manufacturer as “flexible”. (example: Kramer C-MHM/MHM series).
4. Provide strain relief as necessary or as recommended by manufacturer for utilized cable distance.
5. Distances:
   a. For distances up to 35’ use a 24AWG HDMI cable (patch cables <15’ can be 26 AWG)
   b. For distances >35’ use an active Cat 6 HDMI extender.

B. Manufacturers:

1. Cables 2 Go
2. Covid USA
3. Crestron
4. Extron
5. Kramer
6. Monoprice Cabernet Series
7. Approved Equal

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Review mounting locations before installation. Coordinate locations with the electrical contractor and mitigate conflicts with other devices.

B. Coordinate mounting height/locations with existing conditions and mount to avoid covering existing devices or devices to be installed during construction.

C. Contractor shall notify Technology Designer of any conflicts before installation.

3.2 INSTALLATION

A. Contractor shall choose appropriate mounting method and materials for each piece of equipment and location based on manufacturer's requirements, wall construction, building structure, etc.

B. Install all components according to manufacturer's guidelines.

C. Provide raceway as required for the installation to conceal cables.

D. Provide wire management and cable wrap to manage and conceal cables between the wall and source. Submit cable wrap color for approval prior to installation.

E. Provide wire management and cable wrap to manage and conceal cables between the wall and source.

F. Install safety cable for all ceiling and wall mounted equipment supported by the building steel and be independent of any ceiling grid or accessories.

G. Contractor to test and balance all speakers and equipment settings to tune to the system for each space.

H. Coordinate location with electrical contractor. Location shown on drawings is approximate; contractor may shift slightly to avoid obstructions (lights, overhead mechanical, etc.) however location must accommodate the interactive display and marker boards.

I. Mounting height shall be reviewed with Owner for each room configuration. In rooms where an existing chalkboard or markerboard is to remain, the bottom of the display shall be located immediately above the chalkboard/markerboard rail.

3.3 PROGRAMMING

A. Meet with Owner and Technology Designer to discuss the requirements and expectations for the control system functionality and interface. The contractor to propose interface based on the Owner's needs and should anticipate modifying the proposed solution based on Owner feedback.

B. EDID Strategy

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1. Create an EDID strategy where issues arise with differing native display resolutions and source equipment.

2. Document EDID parameters and turn over to the owner as an as-built deliverable.

C. Commissioning

1. After the rollout of the programming graphics and logic, programmer will run through each system with Barton Malow and the Owner to verify functionality and ensure each system functions to the Owner's requirements. Issues with function will be documented and corrected in a timely fashion.

2. After the initial verification, the Owner may make up to 2 functionality/usability revision requests within 12 months which will be accommodated at no additional cost, unless additional hardware or licensing is required to activate a requested feature. A revision shall consist of both the logical and graphical changes required to achieve the requested functionality. This does not include correcting functionality issues found after users begin using the systems regularly, which is a workmanship warranty issue.

3. Contractor to thoroughly test all systems and take corrective actions prior to scheduling demonstrations.

3.4 DEMONSTRATION

A. Contractor to commission the system with the Owner and/or Designer to verify operation and setup prior to user training.

B. Contractor to provide an overview of the system functionality and adjustments for the building staff.

C. Contractor to attend the first event in the space to troubleshoot any issues and adjust the system based on use in occupied space.

D. Contractor to adjust the system based on Owner feedback after space is used for classes and sporting events.

3.5 DOCUMENTATION

A. As-Built Documentation:

1. Spreadsheet by building identifying installed components, location, model number, serial number, and any other pertinent data. Spreadsheet format to be approved by Technology Designer.

2. Schematic diagram indicating equipment and interconnections.

B. Control Diagrams

1. Provide flow diagrams that list out what function each button executes. (Example: Power ON turns on projector, fires relay to lower screen, switches system to stage input plate.)

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2. Contractor to turn over electronic version of source code for all control system programming. Provide both compiled and un-complied code.

C. Manufacturer's Instructions: Provide complete installation, set-up, and maintenance instructions.

END OF SECTION 27 4119

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SECTION 27 5116 – PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 4116 – Classroom AV Systems

1.2 OVERVIEW

A. Install an Audio Enhancement EPIC system using the classroom Optimum soundfield systems along with amplifiers, speakers, etc. for areas without classroom soundfield (e.g. corridors, kitchen, offices, etc.) to create a comprehensive PA system.

B. Include EPIC headend server, EPIC System Kiosk for the main office, and configure for paging from the office as well as call and emergency buttons from classrooms initiating communication with the office.

C. Contractor is to load building map into the system and configure for individual zones to be selected for paging and highlighted during all call/emergency communications.

D. Provide an EPIC District View Head End Server and an additional System Kiosk for the public safety office. Configure to send emergency alerts from any building to the central Kiosk, and send email/text notifications to both the group assigned for each building and also the group assigned for district alerts. Contractor is to setup the first distribution groups and train the Owner on maintaining the list.

1. Install the server in the district data center located in the Hill Center. Rack space and network connection will be provided. Upon contract award provide any network requirements to be provided by the district (e.g. connectivity, IP, VLAN information, etc.)
2. Install the System Kiosk in the public safety office.
3. Provide separate demonstrations for web access to the building administration, central district administration, technology staff, and public safety staff.

1.3 SUMMARY

A. PA system shall provide paging, emergency signal sounding, and time-event signals (bell system) to selectable zones (interior and exterior).

B. PA system is to be network-accessible allowing for administration from any computer on the Owner's network, paging at a remote-building, and multi-building pages for emergency announcements.

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C. Provide bell system schedule through browser-based system. Contractor to obtain the standard daily bell schedule and the bell schedule for pre-programmed non-standard days (e.g. half day, early release, etc.) and create the initial bell schedules in the system.

D. Provide ports, installation, and configuration to integrate with the access control system to play pre-recorded messages during building lockdown.

E. Include a push-to-talk microphone in the main office on the receptionist desk configured for the All-Call paging zone.

F. The system will play pre-recorded messages and tones when initiated from the administrative software or from an alert sent from an external system. Contractor to work with Owner to record all initial messages.

G. The system will be configured to play recorded music (MP3) or music from other electronics through an aux port.

H. Configure system to synchronize time with the master clock system.

I. PA system shall allow for talkback from each classroom. Provide a preannounce tone over speakers before two-way communication is enabled.

J. PA system shall be integrated with the phone system allowing announcements from authorized users to be made from any handset. Announcements shall be active until the user terminates the session by hanging up the handset.

K. Provide a microphone in the main office for all-call announcements in addition to the phone system integration.

L. Include a tones for emergency situations or drills (e.g. tornado drill).

M. PA system will have separate zones for the following areas. Speakers in support spaces can be part of the zone the support space is associated with (e.g. kitchen, servery, kitchen office, food storage areas, etc. can all be included in the cafeteria zone).

1. All Call (all interior speakers)
2. Emergency (all interior + exterior speakers)
3. All exterior speakers
4. Each Instructional Space (classrooms, computer labs, media center, etc.)
5. Cafeteria
6. Gymnasium

1.4 DEFINITIONS

A. PA: Public Address

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Speakers (ceiling, surface mount, horn, etc.)
2. Microphone

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3. Cable

B. Shop Drawings: For each drawing indicated, provide in hard-copy and electronic (PDF) formats.

1. Include a composite floorplan identifying speaker locations and zone assignments.

C. Qualification Data: Include written confirmation from the manufacturer that the Contractor is an authorized factory agent or distributor for the submitted products.

1.6 QUALITY ASSURANCE

A. Audio Enhancement EPIC System must be provided by an authorized EPIC reseller, and installed by Audio Enhancement EPIC Level II Certified installer.

B. Comply with the requirements of NFPA 70.

C. The Contractor shall install in accordance with all applicable codes and standards, including federal, state, and local codes and authorities.

1.7 COORDINATION

A. Coordinate layout, rough-in requirements, and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

B. For new-wall construction, provide speaker backboxes to the contractor identified by the Construction Manager for installation.

C. Coordinate the telephone integration with the telephone contractor or with the Owner’s telephone service company.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The PA system equipment shall be wall-mounted or rack-mounted in the MDF.

B. Provide a UPS to maintain full system functionality between a power outage and the generator restoring power.

C. Integrate with existing Shoretel IP telephone system to allow paging from existing handsets, and paging over existing speakerphones.

1. Provide FXO to FXS connection or SIP trunk to SIP Station handoff as required for interconnection.
2. Coordinate interface and connection with Owner’s telephone system service provider
3. PA system Contractor is responsible for installing the cable between the 2 systems.

D. Provide bell system schedule through a browser-based system. Provide and configure the initial school year bell calendar including holidays and non-typical days.

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E. Synchronize time with the Master Time System. System shall automatically adjust for daylight savings time.

F. The PA system shall provide a minimum of four (4) distinct tones for emergency alerts that are to be initiated through web interface. Each tone shall be programmable for volume, pitch, and duration. Emergency alerts should be distributed to all speakers unless directed otherwise by the Owner or Technology Designer.

G. Provide local volume control in the locations indicated by the drawings and specifications.

H. System shall be addressable to allow each speaker to be assigned to one or multiple zones.

I. System shall contain adequate number of zone cards to meet zone requirements at each building.

J. Amplifiers shall be sized to accommodate all speaker locations defined in the plans and specifications. The system shall also allow for additional speakers to be added (allow for 20% growth).

K. Each input shall have individual volume controls. The unit shall have 1 master volume control.

L. Include programming software, if required.

M. Provide a preannounce tone over loudspeakers.

N. The Contractor is to use plenum rated cabling and accessories throughout the project. All cables shall be continuous and free from splices.

2.2 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Any deviations must be approved in writing by the Technology Designer before installation.

1. Audio Enhancement EPIC — Manufacturer Contact Info:
   Alex North
   alex.north@audioenhancement.com
   (574) 298-4880
2. Approved equivalent

2.3 MICROPHONE

A. Provide desk-type low impedance microphone with push-to-talk switch.

2.4 SPEAKERS

A. All speaker cabling is to be shielded.

B. Where possible, speakers shall be recessed-mounted in suspended ceiling tiles and protected with white grilles.

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C. Ceiling PA speakers and grilles are to be rust-resistant Quam speakers or equivalent with load bearing tile support bridge.

D. Wall/open-ceiling PA speakers are to be Quam System 6VP or equivalent vandal resistant loudspeaker assemblies with durable white powder coat finish. Coordinate backboxes with the masonry and electrical contractors for a final flush-mount speaker.

E. Outdoor PA speakers are to be Quam System 36VPS or equivalent vandal resistant horn loudspeaker assemblies with durable stainless steel construction with white powder coat finish.

F. Any non-recessed speakers must match the surrounding architectural finishes. Speaker selection requires Technology Designer and Architect approval.

G. Appropriate mounting accessories (grilles, enclosures, baffles, etc.) shall be provided and installed with each speaker. Accessories shall be chosen to accommodate installation location.

H. All speakers to be equipped with appropriately sized transformers.

I. Include protective cage for speakers in the gym.

2.5 SPEAKER CABLING

A. Wiring shall be done per manufacturer's recommendation.

B. All terminal connections to be on barrier strips.

C. All cables to be labeled by room.

D. All speaker cabling is to be shielded and plenum rated.

E. Contractor to install conduit between speakers / backboxes where cabling is not concealed above accessible ceiling.

2.6 TELEPHONE ACCESS MODULE

A. Provide a telephone access module or PA to telephone system interface to enable a standard Owner’s handsets to interface with the PA system allowing announcements from authorized users to be made from any handset.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor’s responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Provide all cabling, equipment, and devices to ensure the system will properly function. Any issues with the systems, design, or installation must be brought to the attention of the Technology Designer before the bid is submitted.

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C. Examine pathway elements intended for cabling to verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with manufacturer requirements.

D. Verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

B. The Contractor shall protect equipment and components during installation, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

C. The Contractor shall be familiar with the site and the rooms to ensure a proper installation. The final installation methods are left to the discretion of the contractor in accordance with this specification, within standards of generally accepted workmanship, and in accordance with manufacturer's recommended installation practices.

D. Contractor shall review zone speaker assignments, zone numbering scheme, and tone generator designations with the Owner and Technology Designer before beginning installation. Configure according to Owner requirements.

1. Zone assignments will be consistent for similar spaces across buildings. For example, each building is to have the same assignment for all-call, emergency zones, gymnasiums, cafeterias, etc.

E. After balancing the system, Contractor shall mark all components with variable sound levels indicating the levels recommended.

F. Splice cable only in accessible junction boxes or at terminal block units. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

G. Leave 24" excess cable at each termination at microphone, volume pad, speaker, or other system outlet. Leave 6 feet of excess cable at each termination at the system cabinet. Service loop to be arranged and secured.

3.3 IDENTIFICATION

A. Cable runs shall be machine labeled within 1" of each termination. All cabling is to be tagged in a consistent manner, approved by the Technology Designer.

B. Zone paging modules, tone generators, etc. shall be labeled to designate their configuration.

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3.4 FIELD QUALITY CONTROL

A. Measure and record sound power levels (dB SPL) in all areas (rooms, center of each corridor, near outdoor speakers).

B. Document call and talkback functionality performs properly in all rooms.

1. Verify correct speakers assigned to each paging zones
2. Talk back
3. Emergency tones

3.5 DEMONSTRATION

A. Contractor must test system to make sure all call, zoning, talkback, and lock down drills work properly prior to demonstration. District personnel must be present for an all call and lock down drill test.

B. Demonstrate all system functions (timed events, emergency tones, telephone and clock interfaces, etc.) to Technology Designer.

C. System training to be scheduled at Owner's convenience. Contractor to provide site-specific documentation on the basic operation, programming, bell schedules (standard and holidays), and troubleshooting of the system. Contractor to record training sessions.

3.6 SYSTEM ADJUSTMENTS

A. After initial setup, contractor may be required to make additional site visits within the first year of operation (as set forth from date of substantial completion) to adjust speaker volumes for individual speakers or zones.

3.7 DOCUMENTATION

A. As-Built Documentation:

1. Include composite drawing for each building indicating paging zones, paging zone numbers, and paging instructions.
2. Provide test results log of all systems and zones with date and time of test, the db reading, and who performed the test.
3. Include scaled drawings reflecting all changes between the bid documents and the final installation including cable routing, location of all equipment, speakers, remote volume controls, etc.
4. Drawings for systems showing location and cabinet/enclosure layout. Include all components identifying component manufacturer and model, serial numbers, label, and connections.
5. Schematic drawing indicating equipment models, interconnections, naming, serial numbers, and MAC addresses for IP-based components. Include interconnections to other systems.
6. Spreadsheet indicating the sound level recorded in each area and the test date.
7. Spreadsheet indicating call and talkback functionality has been tested in each room.

END OF SECTION 27 5100

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SECTION 27 5300 – POE CLOCK SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 1500 – Data Horizontal Cabling
4. 27 5100 – Public Address System

1.2 SUMMARY

A. This Section includes the following related to the wireless clock system:

1. Master Clock System
2. POE Digital Clocks
3. Wire Guards

B. The clock system shall continually synchronize clocks throughout the facility, and integrate with the public address system for time synchronization.

C. Related work provided by others:

1. Public address systems or other systems that will use the clock system for time synchronization.

D. Reference standards

1. Federal Communications Division (FCC)
   Part 15 - Code of Federal Regulations.
2. National Fire Protection Association (NFPA).
   NFPA 70E-[2012], Standard for Electrical safety in the Workplace.

1.3 DEFINITIONS

A. PA: Public Address System

B. POE: Power over Ethernet

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1.4 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Clocks
2. Wire Guards

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the equipment manufacturer, for both installation and supervision of the installation of the system.

B. Equipment and components furnished shall be of manufacturer's latest model.

C. Regulatory Requirements
1. Comply with NFPA 70
2. Solution shall not require an FCC license:
3. All components shall comply with Part 90 of FCC rules as follows:
   a. This device may not cause harmful interference, and
   b. This device must accept interference received, including interference that may cause undesired operation.
4. System shall be installed in compliance with local and state authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

1.7 WARRANTY

A. The contractor warrants the system to be free of defects of workmanship or products and will inspect and repair the system during the warranty period at no additional cost to the Owner. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions. No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law

B. The warranty period shall be five (5) years.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Clock system shall synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired. Clocks shall receive a sync signal at a maximum of every 4 hours.

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B. The system shall synchronize all clocks to each other. The system shall utilize Internet-based time sync to provide accurate time. Clocks shall automatically adjust for Daylight Savings Time.

C. System is to have web-based administration.

D. Communication between components is to be in the Power over Ethernet (POE) over the Owner's network.

E. Clocks shall be synchronized so that clock accuracy shall not exceed plus or minus 1 second.

F. The system shall include an internal clock reference so that failure of the network or master clock signal shall not cause the clocks to fail in indicating time.

G. The system shall include a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

H. System to have diagnostic feature allowing users to view when clock is not receiving the signal.

I. Provide contact closures and all labor and materials to synchronize time across the following systems: PA system, bell system.

2.2 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Other systems using wireless technology in an unlicensed frequency range will not be accepted. Any substitutions must be included in the bid as a voluntary alternate and if accepted approved in writing by the technology designer and Owner before installation.

1. Primex Wireless
2. Approved equivalent

2.3 MASTER CLOCK

A. Description: SNTP/NTP-based Master Clock.

1. Provide and configure OneView Sync PoE cloud management system to remotely manage system device settings and monitor system devices.
2. Configure identified user accounts and configure to notify the systems administrator of any devices outages.
3. Change all initial passwords to conform with the Owner's password policy.
4. Coordinate network requirements with owner's IT department.
5. Receive (S)NTP time signal via Ethernet with multiple backup addresses.
6. Automatic bi-annual Daylight Savings Time changes.
7. System shall utilize web-based programming including:
    a. Configure the master clock system
    b. Configure e-mail alerts

2.4 POE DIGITAL CLOCK

A. Description: Digital clocks shall be wall or ceiling mounted as appropriate to the location.

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1. POE IEEE 802.af power using Category 6 cabling.
2. Provide double-sided clocks where shown on the drawings.
3. Operate under DHCP or non-DHCP environments
4. If system stops transmitting valid time signals due to network failure, the clocks will continue to function as accurate clock until a valid time signal is decoded (assuming POE still works to provide power to the clock)
5. Include slope bracket with each clock
6. Provide and install wire guard for clocks in gymnasiums.
7. Typical Format: 4 digit red display
8. Gym Format: 6-digit red display with flush mount kit. Coordinate back box with the masonry and electrical contractors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Prior to installation, a site survey must be performed to determine proper transmitter placement. Any issues with the systems, design, or installation must be brought to the attention of the Technology Designer before the bid is submitted.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Clock locations shall be in the rooms indicated on the drawings. The locations identify the general location only; final location shall accommodate conditions in each room. Clocks shall not be installed until painting and other finish work in each room is complete.

B. The Contractor shall install the system according to the manufacturer's sequence and guidelines and in accordance with NFPA 70E.

C. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

D. The Contractor shall protect equipment and components during installation until final acceptance of the project, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer. Remove temporary labels from clock face (labels on the backs of clocks to remain).

E. At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all clocks are functioning. Prior to final acceptance, inspect each clock, adjust as required, and replace parts which are found defective.

F. Contractor is responsible for the initial configuration of the system including setting the initial annual schedule and events.

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3.3 FIELD QUALITY CONTROL

A. All devices must be tested at their operational location under normal operational conditions to assure reception of signal.

3.4 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information. Contractor to dispose of all packaging.

3.5 DEMONSTRATION

A. The Contractor shall demonstrate for the Technology Designer and Owner that the system operates under manufacturer guidelines under both normal operational conditions and during the loss of network connectivity.

B. The Contractor shall train the Owner on the operation of the system including user administration, clock configuration, modifications to the clock settings (brightness, etc.), clock configuration, configuring alerts, reporting, clock mounting, and removing a mounted clock.

3.6 SPARES

A. Provide the following spare equipment and/or parts

1. Five (5) 4” POE Digital clocks

3.7 DOCUMENTATION

A. Document initial user and clock settings.

B. Manufacturer's Instructions: Provide complete installation, set-up and maintenance instructions.

END OF SECTION 27 5300

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SECTION 275319.11
DISTRIBUTED ANTENNA SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Distributed Antenna System (DAS).

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project adminstrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 07 - Thermal and Moisture Protection: Materials and methods for work to be performed by this installer.

D. Section 260005 - Basic Electrical Requirements

E. Section 260519 - Low-Voltage Electrical Power Conductors and Cables

F. Section 260526 - Grounding and Bonding for Electrical Systems

G. Section 260533.13 - Conduit for Electrical Systems

H. Section 260533.16 - Boxes for Electrical Systems

I. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems.

J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

K. Division 27 - Communications: Structured cabling and communications equipment.

L. Section 284600 - Fire Detection and Alarm: Connections to Fire Alarm and Mass Notification systems.

1.3 ABBREVIATIONS AND ACRONYMS

A. BTS: Base transceiver station.

B. DAS: Distributed antenna system.

C. PSN: Public service network.

D. RF: Radio frequency.

E. WSP: Wireless service provider.

1.4 REFERENCE STANDARDS

A. BICSI 006 - Distributed Antenna System (DAS) Design and Implementation Best Practices; 2020.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2020.

D. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

E. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Predesign Meetings:

1. Conduct meeting with Owner to determine locations of system components and associated electrical/communication service provisions.

2. Conduct meeting with each WSP to determine specific market criteria and design requirements.

B. Coordination:

1. Coordinate work to provide power for system components at required locations.

2. Coordinate work to provide rough-ins for communications cable terminations at required locations.

C. Sequencing:

1. Before activating DAS system, obtain retransmission agreement and approval for interconnection to WSP's macro networks or BTS equipment from each WSP.

1.6 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for system components, including detailed information on materials, construction, ratings, listings, and available configurations.

1. Active Components: Provide mean time between failure (MTBF) data.

C. Certification from manufacturer authorizing proposed design.

D. Delegated Design Documents:

1. Include dimensioned plan views indicating proposed system component locations and cable routing.

2. Include schematic riser diagram indicating component interconnections.

E. Design Data:

1. Indicate specific market criteria for each WSP.

2. Indicate assumed channel loading and frequency bands for each WSP.

3. Indicate RF link budget calculations.

4. Indicate RF propagation modeling predictions.

F. Statement of work, approved by Owner.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

H. Manufacturer's qualification statement.

I. Installer's qualification statement; include documentation of manufacturer certifications and successful installations.

J. Maintenance contract.

K. Operation and Maintenance Data: Include hardware and software manuals for active components.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with at least 3 years of experience manufacturing active and passive components for DAS systems in use in projects of similar size and complexity.

B. Installer Qualifications:

1. Company with at least 5 years experience in installation and testing of DAS systems of similar scope and complexity.

2. Employing BICSI Registered Communications Distribution Designer (RCDD).

3. Employing Certified BICSI Technicians (TECH) for supervision of work.

4. Certified by manufacturer of active and passive components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CommScope, Inc; ERA; www.commscope.com

B. RF Connect; www.rfconnect.com.

C. _____.

2.2 DISTRIBUTED ANTENNA SYSTEM (DAS)

A. Furnish and install a complete and fully functional DAS Equipment and cable distribution system for criteria listed herein.

B. Electrical Contractor shall procure the services of a licensed Signal Testing Agency.

C. Design and provide neutral-host distributed antenna system (DAS) capable of supporting specified wireless service providers (WSPs) and public safety networks (PSNs).

D. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, DAS headend equipment, DAS remote units, C-RAN integration units, access points, structured cabling, and accessories.

E. System shall be designed to the following codes and standards:

1. BICSI 006.

2. TIA-568 (SET).

3. TIA-569.

4. TIA-607.

5. NFPA 70.

6. Requirements of authorities having jurisdiction.

7. Applicable local codes.

F. Performance Requirements:

1. Comply with respective specific market criteria and design requirements of each WSP.

2. On per channel basis, downlink received signal level for each frequency band to meet or exceed specified criteria for minimum of 95 percent of specified DAS coverage area including, but not limited to, stairwells, elevators, basements, and garages unless specifically indicated as excluded.

G. DAS Coverage Area: Entire building.

H. DAS Coverage Requirements:

1. Unless otherwise indicated or specifically excluded by Owner, provide coverage for AT&T, T-Mobile/Sprint, and Verizon in local market.

2. Support commercially licensed land mobile radio (LMR) and public safety bands from 380 MHz through 2,700 MHz.

3. Provide expansion capability to support new licensed bands without replacing existing hardware.

4. Provide capability to support both interleaved MIMO and 2x2 MIMO.

I. Network Management System (NMS):

1. Capable of alarm, monitoring, configuration, and control of active components.

2. Capable of integration with third-party, SNMP-based NMS products for alarm purposes.

J. Structured Cabling:

1. See Division 27 specifications for additional requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual channel loading and frequency use for service area.

B. Verify that ratings and configurations of devices to be connected are consistent with indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's written instructions.

3.3 MAINTENANCE

A. Provide to Owner a proposal as alternate to base bid, a separate maintenance contract for service and maintenance of DAS for one year from date of Substantial Completion including preventative maintenance, system monitoring, spare parts, fault mitigation, equipment repair, and expedited response time.

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SECTION 28 1300 – ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 08 7111 – Door Hardware
2. 27 0000 – General Technology Requirements
3. 27 1000 – General Cabling Requirements

1.2 SUMMARY

A. This Section includes the following major components related to the security system:

1. Regulating access through entry doors
2. Controllers
3. Lockdown buttons and functionality
4. Bus entry

B. The intent is to expand the existing district-wide Continental Access System.

C. Card readers will be integrated into the door hardware or specified in the door hardware schedule and specifications. Refer to those documents for more information.

D. Provide an under-desk building lockdown button in the main office and principal's office including a protective cover.

E. Install new control panel/controller in the MDF Wire each door and bus entry card reader to the location of the access control door panel/controller. The door hardware will be specified with a whip for this contractor to tie into.

F. Contractor will be required to coordinate access permissions with the owner, and apply the required individuals credential information to the new doors. The contractor will also coordinate multiple time schedules (standard school day, early release, holiday, etc.) with the owner and apply time schedules as required to each respective opening.

G. Contractor is to wire and interconnect the card readers, electrified hardware, door operators, and handicap buttons for daily use, after hours use, lockdown events, etc.

H. Integrate with the video intercoms located at the building and office entrances, and classroom pod entrances.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Any substitutions must be demonstrated to the Owner and Technology Designer for approval in writing before installation.

1. Continental Access CA4K Centennial

2.2 CONTROL PANEL

A. Provide Continental Accelaterm system sized for all doors, door contacts, etc. indicated on the drawings.

B. Integrate with Owner's existing multi-building CA4K system.

2.3 CARD READERS

A. Provided by others, wired and configured by this contractor.

2.4 PANIC/LOCKDOWN BUTTON

A. General Requirements

1. Install wireless panic buttons (hold up switches) under the receptionist and principal's desk. Coordinate location with end user.
2. Provide finger-operated RF transmitters, receivers, cabling, and integration into the access control system
3. Upon pressing the lockdown button the system will lock all electrified doors integrated with the access control system.
4. Contractor to program lockdown button to override any door schedules.
5. User credentials will become inactive in a lockdown state. Contractor to create access group with specific personnel that has the ability to override reader programming and allow entry.
6. Users will be given an emergency PIN code to use with the card reader keypads to unlock doors.
7. Alert designated building staff via text and email. Contractor to work with the owner on the list of contacts. This may include emergency responder contacts.
8. Lockdown can only be turned off/disengaged through the access control software.

B. Manufacturer:

1. Honeywell 5869 with RF receiver
2. Approved Equivalent

2.5 ELECTRIC STRIKE

A. Provided by others

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2.6 DOOR CONTACT

A. General Requirements:

1. Provide door contacts for all doors without door contacts integrated into the door hardware in the locations shown on the drawings.
2. Provide wiring and electronics to integrate with the Continental access control system.
3. Contractor will program contact and create events for forced entry.
4. Contractor will program and create events for held open status over three (3) minutes.

B. Manufacturer:

1. Interlogix – 1078C-G
2. Approved equivalent

2.7 MOTION REQUEST TO EXIT DEVICE

A. General Requirements:

1. Contractor shall install, configure, and program motion sensor to shunt door contact(s) on normal exit

B. Manufacturer:

1. Honeywell – IS310WH
2. Approved equivalent

2.8 POWER SUPPLY

A. Manufacturer:

1. Altronix Power Supply (ACMCB)
   a. Provide two (2) 12V 5ah Batteries
2. Approved Equivalent

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Prior to installation, a site survey must be performed to determine equipment placement. Any issues with the systems, design, or installation must be brought to the attention of the Technology Designer and Construction Manager before the bid is submitted.

C. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

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D. Notify the Construction Manager of any conditions that would adversely affect installation or subsequent use.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Review project plan with Technology Designer and Owner to clarify Owner requirements before installation. Create detailed project planning and publish documents for review and approval.

1. Complete system diagnostics and operation verification.
2. Prepare a specific plan for system testing, startup, and demonstration.
3. Develop acceptance test concept and, on approval, develop specifics of the test.

C. The Contractor shall install and configure the system according to the manufacturer's sequence and guidelines as well as generally accepted standard practices.

D. Contractor will provide floorplans/maps in the system software showing the location of doors on the access control system. Maps will include visual notifications based on created events.

E. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

F. The Contractor shall protect equipment and components during installation until final acceptance of the project, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

G. All security devices (proximity readers, keypads, etc.) shall be installed according to ADA requirements.

H. Contractor will integrate with ADA operators to automatically fire and open the door without any further action than presenting a credential at the respective reader. Verify with owner whether this will be configured globally or on an individual user level. Provide any relays or miscellaneous equipment and labor required to successfully implement this feature.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.4 TRAINING

A. Perform training on any updates in software and any modifications to the software.

1. Contractor to perform two (2) 2-hour training sessions for administrators of the system.

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3.5 DOCUMENTATION

A. As-Built Documentation: In addition to the requirements listed in section 27 0000 or 28 0000, include the following:

1. Composite floorplan drawing of each building indicating controlled access location, reader type and system identification, and descriptive title.

3.6 WARRANTY

A. The following warranties shall be provided by the awarded contractor at no additional cost to the Owner.

1. Include a three (3) year complete warranty, including product maintenance/software updates. The awarded contractor will be required to replace any defective product at no additional cost, including labor. The warranty shall cover defects in equipment, workmanship, materials, or system configuration.

B. Final payment shall not relieve the awarded contractor of these obligations.

END OF SECTION 28 1300

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SECTION 28 1350 – ENTRY VIDEO INTERCOM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 - General Technology Requirements
2. 27 1000 - General Cabling Requirements

1.2 SUMMARY

A. This Section includes the following major components related to the security system:

1. IP Entry Intercom
2. Master Station / Answering Device

B. Related work provided by others:

1. Phone System
2. Access Control System
3. Client Computers

C. The awarded contractor will be required to procure and install building signage at each entrance with an entry intercom.

D. The intent of this project is to install a new video entry system at each building. The general requirements include:

1. New “turnkey” entry system.
2. High quality images enabling the receptionist to clearly identify individuals.
3. Allow the receptionist to respond to the visitor, reply with instructions, and unlock the door for entry.

1.3 DEFINITIONS

A. FBO: Furnished By Owner
B. FCC: Federal Communication Commission
C. FF: Fixed Focus
D. IR: Infrared
E. LAN: Local Area Network
F. PoE: Power over Ethernet, IEEE 802.3af standard
G. PoE+: Power over Ethernet, IEEE 802.3at standard
H. TR: Telecommunication Room
I. UPS: Uninterruptible Power Supply
J. UTP: Unshielded Twisted Pair
K. VLAN: Virtual Local Area Network

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L. VMS: Video Management System

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Entry Intercom
2. Master Station

1.5 QUALITY ASSURANCE

A. Contractor must provide evidence that all installation staff have attended manufacturer training.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NECA 1.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: For outdoor locations or locations in a hazardous environment the intercom must meet the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 24 inches thick.
2. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.

1.7 COORDINATION

A. A separate low-voltage cabling contractor will install new Category 6 cabling to the accessible ceiling near new entry intercom locations. This contractor will coordinate with the cabling contractor regarding the installation and final terminations of the new data cabling. This contractor is responsible for coordinating the intercom cabling locations with the data cabling contractor; for making any penetrations between the accessible ceiling and final intercom location, and for the patch cable to connect from the accessible ceiling to the intercom location.

B. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

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C. Coordinate layout and installation of equipment with existing conditions, door operators, ADA operators, access control system, etc.

D. Coordinate requirements and installation with the Owner's technical staff regarding firewall, proxy server, network address translation (NAT), Quality of Service (QoS), IP addressing, etc.

E. Coordinate with the Owner for configuration to integrate with the existing ShoreTel phone system.

F. The awarded contractor will work with the Owner to evaluate and devise a proper VLAN quality of service (QoS) strategy. These strategies will be deployed during this Project. Deployment of the applicable VLANs and QoS settings will configured/deployed by an Owner's representative.

PART 2 - PRODUCTS

2.1 DOOR STATION CAMERA INTERCOMS

A. IP Intercom Specifications

1. General Requirements:

a.	IP Telephone:	Hands free IP SIP 2.0 speakerphone with echo cancellation
b.	Power Source:	PoE (802.3af or 802.3at)
c.	Integrated Camera:	1280x960 minimum Onvif camera
d.	Call Buttons:	One Call button must have integrated braille or the Contractor must install a braille label under/adjacent to the call button. Provide sample for Owner's approval.
e.	Visual Notifications:	Light/pictogram to indicate when receptionist is speaking to visitor Light/pictogram when door is unlocked
f.	Receptionist Interface:	Support web-based, physical answering unit, and IP telephone.
g.	Management Interface:	Web-based
h.	VMS Integration:	Yes
i.	Access Control Integration:	2 independent outputs to support remote door control using DTMF codes
j.	Access Control Reader:	No
k.	Warranty:	3 years

2. Accessories:

   a. Provide appropriate mount back box for each location to mount intercom for best visibility by receptionist for where typical user would stand, or for the existing conditions (e.g. surface mount box, angled bracket, etc.).

3. Cabling:

   a. Existing intercoms have a network cable installed or it will be installed by others. This contractor to extend as needed to new intercom location using a longer patch cable if no service loop is available.
   b. Install an 18/2 communication cable between each new intercom location and the associated door controller. Contractor to survey buildings with project team and Owner to review door controller locations.

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c. Provide conduit for any exposed cabling.

4. Installation:

a. Configure software on receptionist computer to view entry camera image and allow for door release.
b. Configure intercom to call the receptionist's master station / answering unit.
c. Configure intercom as SIP phone to call the receptionist, other phones, or a hunt group and integrate with existing access door controller to release door with key sequence from existing IP phones.
d. Include all mounting hardware, installation, and configuration.
e. Installation must meet ADA requirements.
f. Integrate with handicap door controllers.
g. Provide angled bracket where necessary for the camera to aim at the visitor while the visitor is standing in front of the entry door.
h. Install the answering unit at the receptionist desk.

5. Quantity of Call Buttons

a.	Main Entrance	1
b.	Vestibule 100	1
c.	Rear Vestibule 101	1
d.	200 Pod	6
e.	300 Pod	6
f.	400 Pod	6

6. Color

a. Nickel

7. Manufacturer

a.	2N IP Solo	1-button locations
b.	2N IP Verso 2.0	1-button locations
c.	2N IP Verso 2.0	Multi-button locations (provide 5-button module)
d.	Approved equivalent	

2.2 VIDEO MASTER STATION / ANSWERING UNIT

A. In addition to the master station, provide software/licensing to allow the receptionist computer to view the video feed and configure as a SIP phone station and program the intercom to call the receptionist phone or hunt group.

B. General Requirements

1. IP Telephone: Hands free IP SIP 2.0 speakerphone
2. Power Source: PoE (802.3af)
3. 7" Touchscreen
4. LAN: Ethernet 10/100BaseT, RJ-45
5. WiFi: No
6. Power Adapter: Yes
7. Mount Type: Desk

C. Cabling

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1. Provide patch cable to the desk Cat 6 cable. Identify patch panel and switch port and coordinate port configuration with the Owner.

D. Installation

1. Configure with entry intercom to view the live camera feed, provide 2-way audio communication with users, and unlock the entry door.

E. Manufacturer

1. 2N Indoor View
2. Approved equivalent

2.3 DOOR SIGNAGE

1. General Requirements:
   a. Size: 12”x12” max
   b. Material: Aluminum, rigid plastic, or other outdoor rated material.
   c. Lettering: Review size and layout options with Owner. Include braille lettering.
   d. Wording, layout, and format to be created by the Owner.

2. Installation:
   a. Coordinate the placement of signage at each building with Owner or owner’s representative. Use installation method appropriate for each locations’ conditions and materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor’s responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. The Contractor shall meet and work with the Owner’s staff and Technology Designer to coordinate the system operation, camera locations, camera focal areas, and integration.

C. Prior to installation, a site survey must be performed to determine equipment placement.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Contractor shall install and configure the system according to the manufacturer’s sequence and guidelines as well as generally accepted standard practices.

B. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

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C. The Contractor shall protect equipment and components during installation until final acceptance of the project, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

D. Pre-Installation

1. Contractor to coordinate rough in requirements with the architectural and electrical contractors.
2. Contractor to review intercom naming conventions with Owner.

E. Contractor to provide turn-key installation. See installation information in each Product section above.

3.3 DEMONSTRATION

A. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.

B. Develop site specific training modules and materials for the following:

1. Configuration of the intercom
2. Answering an intercom call
3. Initiating intercom discussion with visitor
4. Releasing the door

C. The Contractor's trainer will supply system documentation and training aids customized to this installation. Documentation shall be tailored for system administrators and typical users.

1. Include training for the IT staff on the administration of the system.
2. Include training for the office staff after installation and testing. Training will need to be coordinated with the office staff and may not occur at the time of installation.

3.4 SYSTEM ADJUSTMENTS

A. After initial setup and use, contractor is to include one trip to each building to review usage with building administrators and to adjust intercom's viewing angle, etc.

3.5 DOCUMENTATION

A. Document configuration settings for the entry intercom and master station.

B. Provide a spreadsheet for all equipment to include:

1. Manufacturer, model number, and serial number
2. Device name and IP address
3. IDF and patch panel port connected to

C. Letter or tabloid sized composite floorplan drawing of each building indicating intercom locations, door controller locations, telecommunication closet location, and cable pathways.

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D. Warranty information including contact information and expiration dates.

E. All documentation is to be delivered in electronic format.

3.6 WARRANTY

A. Include a three (3) year complete warranty, including product maintenance/software updates. The awarded contractor will be required to replace any defective product at no additional cost, including labor. The warranty shall cover defects in equipment, workmanship, materials, or system configuration.

END OF SECTION 28 1350

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SECTION 28 1600 – INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 28 1300 – Access Control
4. 28 2300 – Video Surveillance

1.2 SUMMARY

A. This Section includes the following major components related to the security system:

1. Main Control Panels
2. Infrared/Motion Sensors
3. Glass Break Sensors
4. Dial-out Requirements
5. Monitoring

B. This Section includes the following:

1. Intrusion detection with hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.
2. Responsibility for integrating electronic and electrical systems and equipment.

C. Related work provided by others:

1. Electrical system
2. Public address system
3. Phone system

D. Configure system to disarm upon first authorized entry each morning of the access control system or via the receiving door keypad. System to arm at preset times each day, with varying schedules for weekdays, weekends, holidays, and school breaks. Review schedule and requirements with Owner and Technology Designer.

1.3 DEFINITIONS

A. LCD: Liquid-crystal display.

B. LED: Light-emitting diode.

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C. PIR: Passive infrared.

D. RFI: Radio-frequency interference.

E. UPS: Uninterruptible power supply.

F. Partition: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

G. Zone: A specific sensor (door contact, motion sensor, etc.) within a Partition.

H. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of an intruder in a protected zone.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats including dimensions and data on features, performance, electrical characteristics, ratings, and finishes. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Main Control Panels
2. Infrared/Motion Sensors

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

B. The Contractor will coordinate network communication requirements with the owner.

C. The Contractor will coordinate testing with the Owner and monitoring company. The district’s current monitoring company is EPS Security 800.966.9199.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following are acceptable manufacturers for general equipment within this section, unless noted otherwise for any product. Any substitutions must me demonstrated to the Owner and Technology Designer for approval in writing before installation.

1. NAPCO
2. Bosch
3. Approved equivalent

2.2 SYSTEM REQUIREMENTS

A. Integrate with the Continental Access control system.

B. Provide the most current release of software and patches at the time of implementation.

2.3 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.

B. System Control: Central-station control unit shall directly monitor intrusion detection devices**,** temperature sensors and boiler sensors with connecting wiring in a multiplexed distributed control system or as part of a network.

C. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

D. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print Reports.

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E. Timed Control at Central-Station Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

F. Response Time: Two seconds between actuation of any alarm and its indication at central-station control unit.

G. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

H. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

I. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.4 SYSTEM COMPONENT REQUIREMENTS

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads according to manufacturer and regulatory requirements. Include surge protection for external wiring of each conductor entry connection to components.

B. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to central-station control unit.

2.5 SECURE AND ACCESS DEVICES

A. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

2.6 PIR SENSORS

A. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

1. Wall-Mounting Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m). Provide adjustable coverage pattern as indicated on the drawings.
2. Ceiling-Mounting Unit Spot-Detection Pattern: Full 360-degree conical not less than 70ft diameter.
   a. Coverage Information
      1) Coverage is 360° x 21 m (70 ft) diameter when the detector is mounted between 3.7 m and 7.6 m (12 ft to 25 ft) high.
      2) Coverage is 15 m (50 ft) diameter when the detector is mounted at 3 m (10 ft) high.

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3) Coverage is 12 m (40 ft) when the detector is mounted at 2.4 m (8 ft) high.
4) The pattern consists of 69 zones in 21 barriers. Each barrier is 11 m (35 ft) long and 1.5 m (5 ft) wide at 11 m (35 ft). The barriers are grouped into three groups of seven barriers each. Each group has vertical adjustment for customized coverage.

b. Mounting Considerations
1) A height range of 3 m to 7.6 m (8 ft to 25 ft) is recommended. The detectors can be mounted directly to the ceiling or to a standard 10.2 cm (4 in.) octagonal electrical box. Coverage is adjustable by ±10° horizontally and +2° to -18° vertically

B. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across 2 adjacent segments of detector's field of view.
2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.
3. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.7 GLASS BREAK SENSORS

A. Provide wired glass break sensors for exterior windows shown on the drawings and integrate into intrusion detection system. Configure system to notify central station of any glass breakages.

B. Sensors are to detect both impact and shattering frequencies with a range of 30’ minimum.

C. Wireless solutions can be proposed as a voluntary alternate.

D. Manufacturers:

1. Honeywell FG730 series
2. NAPCO
3. Approved equivalent

2.8 CENTRAL-STATION CONTROL UNITS

A. Construction: Modular, with separate and independent alarm and supervisory system modules. Arrangements that require removal of field wiring for module replacement are not acceptable.

B. Alarm Indication: Audible signal sounds and a plain-language identification of protected zone originating the alarm appears on LED, LCD display at central-station control unit.

1. Alarm activation must send alert notification to users and initiate an audible alert.

C. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Include the following:

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1. Acknowledge alarm.
2. Silence alarm.
3. System reset.
4. LED test.

D. Resetting Controls: Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists.

A. Alphanumeric Display and System Controls: Arranged for interface between operator at central-station control unit and addressable system components, including annunciation, supervision, and test.

1. Display: LCD, 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
3. Built-in proximity reader to use of a proximity card as replacement for a passcode.
4. Color: white.

B. Protected Zones:

1. Elementary schools will be configured as one protected zone.

C. Power Supply Circuits: Central-station control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 20 percent increase in load.

D. UPS shall be sized to provide continuous operation until the building generator comes online.

E. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch high. Identify, with permanent labels, individual components and modules within cabinets.

2.9 CENTRAL-STATION CONTROL-UNIT SOFTWARE

A. Support:

1. Multiuser operator with multiple tasks for each user.
2. Support operation and management of all peripheral devices.
3. File management functions for disk I/O.
4. Printer spooling.
5. Monitor status of UPS.

B. Operator Commands:

1. Help.
2. Acknowledge alarm.
3. Place protected zone in Access.
4. Place protected zone in Secure.
5. Protected zone Test.
6. System Test.

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7. Print Reports.
8. Change Operator.
9. Security Lighting Controls.
10. Display Graphics
11. Command Input Errors: Supervise inputs to ensure that they are correct for proper execution. Provide automatic help when a command cannot be executed due to operator input error.

C. System Access Control: Define system operator capability and functions through password-protected operations at three operator levels. Allow operator level change only by top-level operators and managers.

1. Activate tamper alarm after three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period.
2. Allow at least 32 passwords.
3. Display operator's name or initials in console's first field.
4. Report: Print operator's name or initials, action, date, and time on system printer at log-on and log-off. Do not display or print passwords.
5. Define and assign passwords for the following:

a. System commands.
b. Access to system software.
c. Access to application software.
d. Individual protected zones to be accessed.
e. Access to database.

D. Alarm-Monitoring Software: Monitor all sensors, central-station control units, UPS, and data transmission circuits and notify operator of an alarm condition. Print alarms in red on alarm printer and display on console's text and graphics map.

1. Alarm Display:

a. Display higher-priority alarms first.
b. Oldest unacknowledged alarm has highest priority.
c. Operator acknowledgment of one alarm is not acknowledgment of any other alarm and may not inhibit reporting of subsequent alarms.
d. Type of alarm, location of alarm, and secondary alarm messages.
e. Date and time (to nearest second) of occurrence and operator response.
f. A unique message field with a width of at least 60 characters for each alarm. Allow operator to edit assignment of messages to a protected zone or sensor.
g. 25 secondary messages shall have a field of 4 lines of 60 characters each to allow further information to be entered by operator for each alarm.
h. Store most recent 1000 alarms and allow the data to be recalled, but not edited, by operator using the report generator.

E. Monitor Display Software: Display text and graphic maps that integrate protected zone status. Use for various components and real-time data. Use uniform color codes on all displays as follows:

1. FLASHING RED to alert operator that a protected zone has gone into alarm or that primary power has failed.
2. RED to alert operator that a protected zone is in alarm and that alarm has been acknowledged.
3. YELLOW to advise operator that a protected zone is in access.
4. GREEN to indicate that a protected zone is secure or that power is on.

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F. System Test Software: Enable operator to initiate a test of entire system or a particular portion of system. Store results of each test for future display, or print them out in report form.

G. Report Generator Software: Commands to generate reports for displaying, printing, and storing on disk and tape. Store reports by type, date, and time and print each on report printer. Provide printer spooling. Generating reports shall not interrupt system operations. Allow operator to select report-generation mode, either periodic automatic or on request. Report headers shall automatically include time and date of printing and name of operator generating the report. Exact format of each report type shall be operator configurable. Allow operator to request, at any time, an immediate printout of any report.

1. Periodic Automatic Report Modes: Allow for specifying, modifying, or inhibiting the report to be generated, time the initial report is to be generated, time interval between reports, end of period, and output peripheral.
2. Alarm Report: Include all alarms recorded by the system over an operator-selectable time. Include such information as type of alarm (intrusion, tamper, etc.), type of sensor, location, time, and action taken.
3. System Test Report: This report documents the operational status of all system components following a system test.
4. Access and Secure Report: This report documents all protected zones placed in access condition, time placed in access condition, and time placed in secure condition.

2.10 SYSTEM DIAL-OUT

A. System will include network based communication and include a cellular backup.

B. At each building, provide a system to dial out to up to eight (8) selected phone numbers including the Owner's central alarm monitoring company and Owner specified numbers.

C. System shall provide for power-fail alarm, low-battery alarm, and local notification of alarm condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. Prior to installation, a site survey must be performed to determine equipment placement. Any issues with the systems, design, or installation must be brought to the attention of the Technology Designer.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

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2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

E. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

F. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Contractor shall install and configure the system according to the manufacturer's sequence and guidelines as well as generally accepted standard practices.

B. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

C. The Contractor shall protect equipment and components during installation until final acceptance of the project, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

D. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

3.3 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with manufacturer guidelines and requirements in the Contract Documents.

B. Perform the following field tests and inspections and prepare reports:

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Operational Tests: Schedule tests after pretesting has been successfully completed. Test all modes of system operation and intrusion detection at each detection device. Test for detection of intrusion and for false alarms in each protected zone. Test for false alarms by simulating activities outside indicated detection patterns.

C. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

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3.4 DEMONSTRATION

A. Develop site specific training modules and materials for the following:

1. Arming and disarming entire buildings
2. Arming and disarming individual partitions
3. Keypad operation
4. Identifying fault locations
5. Central monitor procedures

B. Training Hours

1. Include (2) one-hour user training sessions for knowledge transfer for the administrators at each building.

C. The Contractor's trainer will supply system documentation and training aids customized to this installation. Documentation shall be tailored for system administrators and typical users.

3.5 DOCUMENTATION

A. As-Built Documentation: In addition to the requirements listed in section 27 0000, include the following:

1. Provide a letter-size composite floorplan indicating partitions, sensor locations and door contacts with their designated labels. In addition to copies included in the as-built submission, provide one copy to each building office.

2. Provide a letter-size composite floorplan indicating partitions, sensor locations and door contacts with their designated labels to each building office stored in or on the outside of the control panel.

3. Provide an electronic copy composite floorplan indicating partitions, sensor locations and door contacts with their designated labels. In addition to copies included in the as-built submission, provide one copy to each building office.

4. Provide an AutoCAD or Revit drawing showing equipment types, equipment locations, cable routing, and zone designations. Provide as PDF and in native format.

END OF SECTION 28 1600

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SECTION 28 2300 – VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Sections:

1. 27 0000 – General Technology Requirements
2. 27 1000 – General Cabling Requirements
3. 27 1500 – Data and Voice Horizontal Cabling

1.2 SUMMARY

A. This Section includes the following major components related to the security system:

1. Servers and Storage
2. Video Management System (VMS)
3. Surveillance Cameras

B. Related work provided by others:

1. Electrical System
2. Network Equipment

C. Existing Network Infrastructure:

1. All buildings are connected via a leased internet connection to the district's data center located at the Hill Center. Most buildings have a 10GB connection.
2. The network is primarily based off Aruba 2920 series PoE+ switches. Contractor will need to provide power injectors for any cameras requiring more power.

D. Existing Video Surveillance System

1. The district has an existing Milestone Professional Plus video surveillance system that this contractor will expand.
   a. SLC: M01-C05-222-01-6C4D5F
   b. Current Care Expiration: 06/30/27
   c. New camera licenses are to co-term with this date
2. Each building currently has it's own local server(s) with the management server located in the data center at the Hill Center; but they will likely consolidate all servers to the Hill Center before this project finishes.

E. New Video Surveillance System Summary

1. The Contractor is responsible for providing, installing, patching, wire managing, labeling, configuration, and interconnecting video surveillance equipment as required to provide a complete turn-key video surveillance system.

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2. Coordinate with the Owner's designee to create an IP scheme, and coordinate IP addressing and camera naming on the system.
3. Configure all analytics according to the Owner's needs.
4. Provide all required end user and administrative training.

1.3 DEFINITIONS

A. B/W: Black & White
B. DAS: Direct-Attached Storage
C. DVR: Digital Video Recorder
D. FBO: Furnished By Owner
E. FCC: Federal Communication Commission
F. FF: Fixed Focus
G. IR: Infrared
H. ISM: Information Security Management
I. LAN: Local Area Network
J. MPEG: Moving Picture Experts Group
K. NAS: Network Attached Storage
L. NAT: Network Address Translation
M. NTP: Network Time Protocol
N. NTSC: National Television System Committee
O. NVR: Network Video Recorder
P. PD: Powered Device
Q. PoE: Power over Ethernet, IEEE 802.3af standard
R. PoE+: Power over Ethernet, IEEE 802.3at standard
S. PSE: Power Source Equipment
T. PTZ: Pan/Tilt/Zoom
U. PDU: Power Distribution Unit
V. QoS: Quality of Service
W. RF: Radio Frequency
X. SAN: Storage Area Network
Y. TR: Telecommunication Room
Z. UPS: Uninterruptible Power Supply
AA. UTP: Unshielded Twisted Pair
BB. VLAN: Virtual Local Area Network
CC. VMS: Video Management System
DD. WAN: Wide Area Network

1.4 GENERAL REQUIREMENTS

A. The VMS shall offer centralized management of all devices, servers and users, and offer a rule-based system driven by schedules and events.

B. The intent of this project is to expand the existing video surveillance system at the buildings and locations identified in the drawings. The general requirements include:

1. High quality images enabling the owner to clearly identify individuals.
2. Minimum of 31 days of video storage on all cameras.
3. Designated staff members will be able to view the IP surveillance system from their networked workstations. In addition, the awarded contractor will be required to setup and configure the VMS so that staff members will be able to view both individual cameras and the created "shared" views via an iOS and Android device within the District and from outside the District. The awarded contractor will be required to setup the server(s) so that "shared" views will be accessible outside the District. Furthermore, the awarded

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contractor will work in conjunction with the Owner's technical staff in setting up any firewall rules to accommodate the inbound and outbound network traffic.

4. Cameras must capture color images in normal light and black & white images in low light.
5. As applicable, the contractor will include any required separate power supplies and cabling for the heater/blower utilized by exterior cameras. Place these power supplies in telecommunication closets unless noted otherwise or agreed upon in writing during the pre-install walkthrough.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, provide a product data sheet in both hard-copy and electronic (PDF) formats. Data sheets indicating multiple products must have the applicable product highlighted or marked.

1. Video Management Software
2. Surveillance Cameras (including applicable camera mounts and housings)

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access control system shall comply with SIA TVAC.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Products must withstand the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 24 inches thick.
2. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
3. Interior Harsh/Humid Environments: System components located in interior areas where humidity levels may be high, unconditioned spaces, or there may be higher levels of chemicals in the air (i.e. natatoriums) shall be rated, listed, and installed to prevent damage to all system components including but not limited to cameras, mounts, cabling, etc. All items shall be warrantied against such damage.

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1.8 COORDINATION

A. Coordinate layout and installation of the work of this section with the Owner's equipment, furniture, electrical, mechanical, architectural, and other technology trades.

B. Coordinate layout and installation of surveillance or display equipment and suspension system components with other construction that penetrates ceilings or walls or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

D. Coordinate requirements and installation with the Owner’s technical staff regarding firewall, proxy server, network address translation (NAT), network time protocol (NTP), Quality of Service (QoS), IP addressing, etc.

E. The awarded contractor will work with the Owner to evaluate and devise a proper VLAN quality of service (QoS) strategy. These strategies will be deployed during this Project. Deployment of the applicable VLANs and QoS settings will configured/deployed by an Owner’s representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. After the bid opening the Owner will select the bidders whose proposals they feel best serve the district. Selection will be based on cost, functionality, installer references, etc. in determination of the most responsive bidder.

B. The following are acceptable VMS manufacturers for general equipment within this section, unless noted otherwise for any product.

1. Milestone Systems Professional Plus
2. Approved Equivalent

C. The following are acceptable camera manufacturers for general equipment within this section, unless noted otherwise for any product.

1. Axis Communications [Basis of Design]
2. Hanwha
3. Approved Equivalent

D. Any substitutions must be demonstrated to the Owner and Technology Designer for approval in writing before installation.

2.2 SYSTEM REQUIREMENTS

A. Provide the most current release of software and patches at the time of implementation. Include costs of all software updates throughout the warranty period. At the end of the warranty period the Owner will be on the latest release of the software.

B. Protect signal cables and connected components against transient-voltage surges by suppressors and absorbers designed specifically for the purpose.

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C. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.

1. Surveillance contractor will provide and install all exterior cameras with surge protection at the camera end.

2.3 VIDEO MANAGEMENT SYSTEM (VMS)

A. Alarms Support

1. The Contractor is to configure the system to send alerts to the system administrator for events such as:
   a. Camera block fully or partially (active tampering)
   b. If the surveillance camera image becomes blurred because of the camera being out of focus
   c. Loss of network connectivity
   d. Server hardware or storage issues

B. Maps

1. The Contractor will implement VMS mapping where digital maps are used to represent the physical location of cameras and other devices throughout the surveillance system.
2. Maps shall have hyperlinks to create a hierarchy of interlinked maps.

2.4 SERVER / STORAGE

1. Existing servers will be used. Contractor to provide requirements after contract award.
2. Contractor will be responsible for configuration changes and camera configuration in the existing system.

2.5 SURVEILLANCE CAMERAS

A. Basis of Design Cameras: Provide cameras meeting the specifications of the following cameras as a minimum.

1.	2MP	Axis P3265-LV/LVE
2.	5MP	Axis P3267-LV/LVE
3.	5MP Dual-Head Camera	Axis P4707-PLVE
4.	12MP Fisheye 360	Axis M34318-PLVE
5.	15MP Multisensor (4 Independent)	Axis P3719-PLE
6.	360 Multisensor	Axis P3727-PLE
7.	180 Panoramic Multisensor	Axis P3827-PVE

B. General Camera Requirements: Dome camera (unless noted otherwise), assembled and tested as a manufacturer unit, containing dome assembly, camera, zoom lens, receiver/driver.

1. Comply with UL 639.
2. Compression: H.264, H.265 or Motion JPEG
3. Cameras shall produce usable images in low-light conditions to 1 lux (color) and .2 lux (B&W)

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4. Cameras should capture color images in normal light and black & white images in low light.
5. Selectable modes for backlight compensation or normal lighting.
6. Camera bases to be cast aluminum with polycarbonate housings.
7. Provide and install adequate power supplies and cabling for camera requiring power beyond POE+
8. Unless noted otherwise, all cameras should be equipped with a varifocal lens.
9. Camera Management Application/Tool
    a. The camera manufacturer must offer a management application/tool to manage their cameras.
    b. The camera management application/tool will allow for the following features:
        1) Discovering of new devices (cameras)
        2) Providing unit status
        3) Device configuration
        4) Device management
        5) Firmware upgrades
        6) Cameras will be allowed to be tagged or grouped by physical location/building

C. General Lens Requirements: Optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide color-corrected lenses with color cameras.

1. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
2. Fixed Lenses: With calibrated focus ring.
3. Zoom Lenses: Motorized, remote-controlled units, rated as "quiet operating." Features include the following:

    a. Electrical Leads: Filtered to minimize video signal interference.
    b. Motor Speed: Variable.
    c. Lens shall be available with preset positioning capability to recall the position of specific scenes.

D. Exterior Camera Requirements: Provide the appropriate mount for each installation type. Multi-lens camera.
1. Multi-lens cameras shown on the building exterior must include a corner mount, attachment accessories, and flexible outdoor conduit as necessary to complete the installation.
2. Multi-lens cameras shown mid-way on an exterior wall must include the required mount to provide horizontal installation to optimize the use of the cameras lens capabilities.
3. Single-lens cameras on the building exterior must include accessory sunshield or utilize a 90 degree mount to provide appropriate shielding from direct sunlight, weather, and UV exposure.

E. General Requirements

1. Day/Night IR capability
2. Minimum resolution is identified on the drawings.
3. Wide Dynamic Range (WDR)
4. Vandal-resistant housing
5. H.264 and H.265 compression
6. Onvif compliant
7. Remote focus and zoom for all lenses.
8. Bandwidth reduction enabled.
9. Multi-sensor models shall require a single IP address and license unless otherwise noted.

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2.6 CAMERA-SUPPORTING EQUIPMENT

A. General Requirements:

1. Alignment Provisions: Camera mounting allows for easy camera aiming and permits removal and reinstallation of camera-lens unit without disturbing camera alignment.
2. Rated for load in excess of the total weight supported times a minimum safety factor of two.
3. Outdoor Units: Rated for a wind load of 100 mph (160 km/h).
4. Camera Viewing Window: Polycarbonate lens aligned with camera lens.

B. Mounting Brackets for Fixed Cameras: Type matched to the items supported and mounting conditions. Include manual pan-and-tilt adjustment.

C. Protective Housings for Fixed and Movable Exterior Cameras:

1. Steel or vandal resistant polycarbonate dome, dustproof exterior enclosures with internal camera mounting and connection provisions that are matched to camera/lens combination and mounting and installation arrangement of camera to be housed.
2. Include built-in thermostat-activated heater and blower units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
3. Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the installed environment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the Contractor's responsibility to review the site work, architectural, structural, mechanical, and electrical drawings, specifications, and field conditions, for any details that may impact the installation or provisioning of the system.

B. The Contractor shall meet and work with the Owner's staff and Technology Designer to coordinate the system operation, camera locations, camera focal areas, and integration.

C. Prior to installation, perform a site survey to determine equipment placement. Any issues with the systems, design, or installation must be brought to the attention of the Technology Designer before the bid is submitted.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install and configure the system according to the manufacturer's sequence and guidelines as well as generally accepted standard practices.

B. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.

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C. The Contractor shall protect equipment and components during installation until final acceptance of the project, and clean all equipment before Owner acceptance using methods and materials recommended by the manufacturer.

D. Surveillance Cameras

1. The contractor shall carefully follow instructions in documentation provided by the manufacturer to insure all steps have been taken to provide a reliable, easy-to-operate system.
2. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation to provide the maximum field of view and security.
3. All firmware found in the products shall be the latest and most up-to-date provided by the manufacturer, or of a version as specified by the provider of the video management system. If in the event that a newer firmware revision is released by the manufacturer, during the project but prior to "final" acceptance, the awarded contractor will be required to deploy the latest firmware to the components/products (i.e. surveillance cameras).
4. All equipment requiring users to log on using a password shall be configured with user/site-specific password(s). No system/product default passwords shall be allowed.
5. The awarded contractor will be responsible for configuring each surveillance camera with a name chosen by the Owner along with its applicable configuration settings. The naming convention of the surveillance cameras will be discussed in the design meetings.
6. Review all exterior cameras with the owner and configure motion masking where the following conditions occur in the view:
   a. Tree branches and leaves
   b. Unwanted street traffic
   c. Activity on neighboring private properties
7. Review all cameras with the owner and create privacy masking on computer screens and other areas deemed necessary.
8. Contractor shall configure pre/post event triggers for 10 seconds on all cameras.

E. Interior Surveillance Cameras

1. When utilizing lay-in ceilings, the contractor is to install a security cable between each camera and the building structure or ceiling tile bridge so the camera is supported independent of the ceiling tile.
2. Install so the structured data cabling system is not visible after the surveillance camera has been securely mounted.
3. Some locations will require the surveillance camera to be mounted on a wall. In this case, the awarded contractor shall utilize Wiremold® V700® or equivalent metal raceway.
4. The Wiremold® V700® metal raceway shall consist of the raceway, appropriate fittings (i.e. mounting clips and straps, bushings, etc.) and device boxes for a complete installation.
5. Due to the width of the interior hallways and stairwells, the field of view/camera image may have to be rotated so that the optimal field of view is deployed. The awarded contractor should account for the necessary time to account for this task.

F. Exterior Surveillance Cameras

1. External mounts shall be sealed to prevent any water or environmental condition from entering the surveillance camera.
2. The structured data cabling system may not be visible at any time after the surveillance camera has been securely mounted.
3. During the initial walkthrough, the awarded contractor will review the proposed mounting locations and determine the optimal height of each surveillance camera. The height of each surveillance camera shall provide that camera with the best quality of picture.
4. All exterior cameras are to be installed with surge protectors at the camera end.

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G. Video Management System

1. Servers must be configured and fully installed before any internal or external cameras are mounted. Cameras are to be integrated and brought online as they are installed.
2. The awarded contractor shall meet with the Owner and Technology Designer, prior to installation, to discuss all aspects of the VMS and its storage component(s) (including recording, storage, archiving, retention, etc.)
3. The awarded contractor will be required to configure each of the surveillance cameras' properties (i.e. resolution, frame rate, sensitivity to motion, etc.) within the VMS.
4. Each server or storage component must be labeled with the applicable component name and IP address.
5. All firmware, including device packs, found in the VMS equipment and software shall be the latest and most-up-to-date provided by the manufacturer, or of a version as specified by the provider of the VMS.
6. All equipment requiring users to log on using a password shall be configured with user accounts from Microsoft® Active Directory. No system/product default passwords shall be allowed. In addition, the service accounts and system administrator shall utilize different passwords. As a direct result, if the system administrator password is modified, the various services will not be affected.
7. All permission levels, as directed by the Owner, will be configured by the awarded contractor. In addition, the awarded contractor will be required to link the Microsoft® Active Directory user groups within the VMS.
8. Each building will have its' own folder within the directory of buildings. The awarded contractor will be required to create all of the various folders. The names of the folders will be discussed within the initial design meetings. In addition, the awarded contractor will be required to create all default views within each building. All network cameras must be included in at least one default view. The default views must not contain a high number of cameras where the view slows down the various workstations or laptops. As a rule, eight (8) network cameras is the greatest number of cameras per view.
9. The awarded contractor will be required to implement the interactive mapping function of the VMS to enable users with the ability to preview a camera by "mousing over" a camera icon. In addition, all the exterior doors are labeled with number for life safety purposes. The contractor will include the door numbers on the mapping software. The number on each door will be provided by the Owner. Real-time updates of system components shall be displayed directly on the map. All building maps/images will be provided by an Owner's representative, except district level maps that will be created using satellite imagery by the contractor.
    a. Create a hierarchy of interlinked maps, starting from a broad view of the district, hyperlink to each site view for exterior cameras.
        1) Contractor to create an overview of the district utilizing satellite imagery with target hyperlinks at each precise building location.
    b. Create multi-layer hyperlinks at each site.
        1) Hyperlink from each site's exterior view to an interior view of each level of the building.
        2) Each level of the building will have its own hyperlinked map. Create an on-screen button to hyperlink between levels.
10. All interior and exterior cameras are labeled with a number for life safety and troubleshooting purposes. The surveillance contractor will work with the owner on a labeling scheme. Surveillance Contractor will label all cameras prior to installation. These numbers will be required to be transferred to the interactive mapping function. All labels must be rated for external conditions. Any labels that fall off during the warranty period are to be replaced at no cost to the Owner. The awarded contractor will be required to create a rule, within the VMS solution, that will notify the District administrators that a surveillance camera has lost its network connection. This particular rule must be applied to all surveillance cameras.

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11. The “camera tampering” alert shall also be enabled within each network camera. In addition, the VMS must recognize the condition and alert the Owner if this condition is met. The contractor is to configure the alerts based on the Owner’s preference.
12. The VMS shall direct all cameras to obtain their time from a District specified NTP (Network Time Protocol) server. If the Owner doesn’t have an existing NTP server, the contractor shall configure the NTP on one of the security servers or through a third party.
13. Load balance each building’s cameras across multiple servers. If a server fails, the entire building will not suffer due to a camera outage.
14. Load balance all servers to prevent video loss due to over buffering (exceeding the processing limits of any single server).

H. Camera Management Application/Tool

1. Contractor to discover all network cameras and import them into the management application.
2. Each building will have its own folder. Within each building folder, each installed model will have its own folder.
3. Populate each camera within the appropriate folder to allow for simpler future camera management.

3.3 FIELD QUALITY CONTROL

A. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video surveillance equipment for acceptance and operational testing as follows:

1. Verify operation of auto-iris lenses.
2. Work with Owner and to set all varifocal lenses.
3. Set and name all preset positions; consult Owner's personnel.
4. Set sensitivity of motion detection.
5. Connect and verify responses to alarms.
6. Verify operation of control-station equipment.

3.4 SYSTEM ADJUSTMENTS

A. Before customer sign off takes a place, a walkthrough with the awarded contractor, building administration, IT Director and Technology Consultant will take place to approve field of views and focus of all surveillance cameras. The awarded contractor will have at least a total of three (3) personnel onsite to make changes during walkthrough for approval. One (1) staff member viewing the cameras and two (2) staff members making any necessary adjustments.

B. Six (6) months after initial setup and substantial completion, Contractor is to include one trip to each building to review VMS usage with building administrators and to adjust any individual camera’s viewing angle, etc.

3.5 DOCUMENTATION

A. As-Built Documentation:
1. All of the items below must be included in a three-ring binder that will be presented to the Owner during the “close out” meeting. The following items are to be a minimum:
   a. Awarded Contractor’s Contact Information

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b. Contractor's Guarantee/Warranty
c. VMS Licensing Information
d. Operations & Maintenance Manuals/CDs
e. Spreadsheet with the following for each server and camera
    1) Equipment manufacturer and model
    2) Serial Number
    3) MAC address
    4) IP address (if static IP addresses are used)
    5) Installed location (building and location description)
    6) Data cable number, closet location
    7) Network port information

2. A set of drawings showing locations of all equipment locations and approximate cable paths.
3. Documentation (including contact information) on the equipment warranties, warranty expiration, manufacturer and Contractor technical support number, and applicable software assurance(s)
4. Manufacturer specification/cut sheets for the systems and equipment installed.
5. Installation and programming manuals for all hardware and software components.

3.6 WARRANTY

A. Contractor is to register all equipment in the Owner's name, not the Contractor's. All manufacturer warranty and support must be available to the Owner directly and not required to channel through the Contractor, distributor, or other entity.

B. The Contractor warrants the system to be free of defects of workmanship or products and will inspect and repair the system within twenty-four (24) hours during the warranty period at no additional cost to the Owner. The Contractor shall respond on site within four (4) hours notice, and without cost to the Owner, during this warranty period. Contractor agrees to correct system deficiencies and replace components that fail in materials or workmanship including deficiencies arising when used according to the manufacturer or Contractor's written instructions. No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law.

C. Warranty Duration

1. All equipment will be provided with a five (5) year hardware and software warranty unless noted otherwise.

D. Contractor will be responsible for servicing any new servers during the warranty period. Contractor will be responsible to coordinate camera replacement and shipping, though the Owner can physically install warranty cameras.

E. Bidders are to extend the same hardware and software warranty duration for their entire proposed base bid and alternate solution(s) whether the item is to comply with the base bid or whether it is a value-added benefit of the solution not specifically requested in the specifications but provided as part of the proposed solution.

F. The warranty shall include phone support and software assurance including patches, updates and version upgrades for both major and minor releases throughout the warranty period.

G. The Owner shall not be responsible for additional charges during the equipment warranty period. Labor, service charges, trip charges, etc. to configure and install equipment during the warranty period shall be included in the contractor's warranty.

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H. Contractor is to provide documentation for all manufacturer's warranties including the operating conditions required for the warranty.

I. Contractor is also to provide terms of any additional warranties as a manufacturer's standard. Special warranty specified shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

END OF SECTION 28 2300

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SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project adminstrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 07 - Thermal and Moisture Protection: Materials and methods for work to be performed by this installer.

D. Division 08 - Openings: Door hardware, coiling fire doors and smoke and/or fire curtains to be released by fire alarm system.

E. Section 083323 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.

F. Section 211300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

G. Section 233300 - Air Duct Accessories: Smoke dampers and Smoke detectors monitored and controlled by fire alarm system.

H. Section 260005 - Basic Electrical Requirements.

I. Section 260533.13 - Conduit for Electrical Systems.

J. Section 260533.16 - Boxes for Electrical Systems.

K. Section 260553 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. Copy (if any) of list of data required by authority having jurisdiction.

2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.

4. System zone boundaries and interfaces to fire safety systems.

5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.

6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.

7. List of all devices on each signaling line circuit, with spare capacity indicated.

8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.

9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.

10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.

12. Certification by Contractor that the system design complies with Contract Documents.

D. Evidence of installer qualifications.

E. Evidence of instructor qualifications; training lesson plan outline.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.

2. Submit documentation of satisfactory inspections and tests.

3. Submit NFPA 72 "Inspection and Test Form," filled out.

H. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Complete set of specified design documents, as approved by authority having jurisdiction.

2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.

3. Contact information for firm that will be providing contract maintenance and trouble call-back service.

4. List of recommended spare parts, tools, and instruments for testing.

5. Replacement parts list with current prices, and source of supply.

6. Detailed troubleshooting guide and large scale input/output matrix.

7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.

8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

I. Project Record Documents: Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.

2. "As installed" wiring and schematic diagrams, with final terminal identifications.

3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

J. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.

2. Installer Personnel: At least 2 years of experience installing fire alarm systems.

3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:

1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.

2. National Time & Signal: www.natsco.net.

3. Siemens Building Technologies, Inc: www.usa.siemens.com.

4. Edwards Fire Safety, a brand of Carrier: www.edwardsfiresafety.com.

5. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:

1. Same manufacturer as control units.

2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.

3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

a. ADA Standards.

b. The requirements of the State Fire Marshal.

c. The requirements of the local authority having jurisdiction .

d. Applicable local codes.

e. Contract Documents (drawings and specifications).

f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.

5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.

6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.

7. Program notification zones and voice messages as directed by Owner.

8. Fire Alarm Control Unit: New, located at main office.

B. Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By remote supervising station.

2. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:

1. Initiating Device Circuits (IDC): Class B, Style A.

2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.

3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:

1. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.

2. Secondary: Storage batteries.

3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.

2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.

3. Duct smoke detectors.

C. Lighting Control

1. Connection between fire alarm systems and lighting control systems.

a. Upon activation of fire alarm system, lighting control system shall provide full illumination to all emergency fixtures along path of egress for 90 minutes, or until alarm is reset.

D. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2. Control Modules: Shut down air handlers indicated.

E. Sound and Entertainment Systems:

1. Turn off Sound and Entertainment Systems upon activation from Fire Alarm controller.

F. Doors:

1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 087100.

2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Division 08.

3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 083323.

2.4 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.

2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: as specified in Basis of Design.

D. Remote Annunciators: locate per plans.

E. Initiating Devices:

1. Addressable Systems:

a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.

b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.

1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

2. Provide one for each control unit where operations are to be performed.

3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.

4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:

1. Hands-On Instruction: On-site, using operational system.

2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:

1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:

1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.

3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.

5. Repeat demonstration until successful.

3.5 MAINTENANCE

A. See Division 01 for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.

2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.

3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within 2 hours of notification.

2. Include allowance for call-back service during normal working hours at no extra cost to Owner.

3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.02 SUMMARY

A. This Section includes the following:
   1. Protecting existing trees, shrubs, and other vegetation to remain.
   2. Removing existing trees, shrubs, and other vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above-grade and below-grade site improvements.
   6. Disconnecting, capping, or sealing, and abandoning site utilities in place or removing site utilities.
   7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:
   1. Division 312000 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
   2. Division 329200 Section “Turf and Grasses” for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.03 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site unless otherwise noted on the plans.

1.05 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Closeout Procedures.
   1. Identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract. Contractor is to confirm that this authority has been obtained before beginning work on adjoining property.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 2000 Section "Earth Moving."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site. Contractor is responsible for doing an independent earthwork computation and including all necessary import and/or export of materials in their bid.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction. If said points will be disturbed, establish new points prior to removal.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and the sediment and erosion control drawings, whichever is more stringent.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls only after all areas are restored and stabilized.

3.03 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within fenced areas.
   2. Do not permit vehicles, equipment, or foot traffic within fenced areas.
   3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cutting minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within tree protection zone.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths is encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile topsoil material in locations approved by the Owner or Engineer.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.08 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, other vegetation, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Burning materials on project property is prohibited.

END OF SECTION

SECTION 311012 – FINE GRADING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Bidding and Contract Requirements, and General and Supplemental Requirements which are hereby made a part of this section.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.02 SUMMARY

A. Work included: All labor, materials, necessary equipment and services to complete the Fine Grading work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as not in contract on the plans.

B. Related work specified elsewhere:
   1. Division 312000 Section "Earth Moving."
   2. Division 329200 Section "Turfs and Grasses."
   3. Division 329113 Section "Soil Preparation."

1.03 SITE INSPECTION

A. The Contractor shall visit the site and acquaint himself with all existing conditions. The Contractor shall be responsible for his own subsurface investigations, as necessary, to satisfy requirements of this Section. All subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the landscape Engineer or Owner's Representative.

1.04 UTILITIES

A. Before starting site operations verify that the earlier Contractors have disconnected all temporary utilities which might interfere with the fine grading work.

B. Locate all existing, active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or transversing the site that are designated to remain.

C. Observe rules and regulations governing respective utilities in working under requirements of this section. Adequately protect utilities from damage, remove or relocate as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in excavation. Record location of active utilities.

D. Contact "Miss Dig" for existing utilities survey confirmation.

1.05 QUALITY ASSURANCE

A. Requirements of all applicable building codes and other public agencies having jurisdiction upon the work.

B. Primary emphasis should be given to the aesthetic appearance and functioning of berming and swales, as directed by the Landscape Engineer or Owner's Representative. The Contractor shall employ skilled personnel and any necessary equipment to insure that finish grading is smooth, aesthetically pleasing, drains well and is ideal for receiving sod and plant materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Existing Soil:
   1. Strip existing topsoil for new construction unless otherwise directed by Owner's Representative, free from debris, sod, biodegradable materials and other deleterious materials. The Contractor shall insure that all existing soil has sufficient percolation and surface drainage to support grasses and plant material and that extreme compaction occurs only in areas to receive paving.
   2. In areas to receive seed, verify that soil is scarified to depth of 3 inches and that soil contains enough organic matter to support and encourage rooting of seeded lawn.

PART 3 EXECUTION

3.01 EXAMINATION

A. Job Conditions
   1. Dust control: Use all means necessary to prevent dust from construction operations from being a nuisance to adjacent property owners and from damaging finish surfaces on adjacent building, paving, etc. Methods used for dust control are subject to approval by the Engineer or Owner's Representative.
   2. Burning: On-site burning will not be permitted.
   3. Protection: Use all means necessary to protect curbs, gutters, sprinklers, utilities and vegetation designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings to damaged plants necessary to the approval of the Landscape Engineer. Contractor shall incur all cost for the replacement of damaged objects and vegetation.

3.02 SCHEDULING

A. Schedule all work in a careful manner with all necessary consideration for adjoining property owners and the public.

B. Coordinate schedule with other Contractors to avoid conflicts with their work.

3.03 EXCAVATION

A. Excavate where necessary to obtain subgrades, percolation and surface drainage as required.

B. Materials to be excavated are unclassified.

C. Remove entirely any existing obstructions after approval by the Engineer's or Owner's Representative.

D. Remove from site and dispose of debris and excavated material not required.

3.04 GRADING

A. The Contractor shall establish finished grades as shown on the construction plans and as directed by the Engineer, including areas where the existing grade has been disturbed by other work.

B. Finished grading shall be smooth, aesthetically pleasing, drain well and ready to receive sod and other plant material to full satisfaction of the Owner's Representative, Engineer and Construction Manager.

3.05 COMPACTION

A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.
   1. Under buildings, roadways, curbs, walks and other paved areas: compaction shall be to 95% of maximum density.
   2. Under landscaped area, compaction shall not exceed 85% of maximum density.

B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the Owner's Representative, and in no case until the masonry has been in place seven days.

C. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry or other exposed building surfaces.

3.06 CORRECTION OF GRADE

A. Bring to required grade levels areas where settlement, erosion or other grade changes occur. Adjust grades as required to carry drainage away from buildings and to prevent ponding around the buildings and on pavements.

B. Remove all rock or objectionable material larger than one inch in any direction prior to commencing landscaping.

C. Contractor shall be responsible for stabilizing grades by approved methods prior to landscaping, and shall be responsible for correction of grades as mentioned above, and clean up of any wash outs or erosion.

END OF SECTION

SECTION 311018 – SOIL EROSION CONTROL

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.02 SUMMARY

A. The work under this Section includes, but not limited to all work necessary for effective soil erosion control in conformance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources Environmental Protection Act guidelines and all pertinent local enforcing agency rules and regulations, having jurisdiction.

B. Related Sections include the following:
   1. Division 312000 Section "Earth Moving."

1.03 STANDARDS

A. General: Perform all work under this Section in accordance with all pertinent rules and regulations, including, but not necessarily limited to those mentioned above and these Specifications.

B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 PRODUCTS

2.01 SEED, FERTILIZER, MULCH

A. Refer to other Specification Section in Part 3.

PART 3 EXECUTION

3.01 GENERAL

A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion control in accordance with the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources guidelines, local enforcing agency guidelines and these Specifications.

B. Site evaluation: Prior to start of the Work, conduct a field evaluation of the site along with representatives of the Engineer and the local enforcing agency.

C. Permits: Contractor is responsible for obtaining all pertinent permits including a Soil Erosion Control Permit if required from the county or local enforcing agency. Submit the NPDES Notice of Coverage when the soil erosion permit is received if not already done.

3.02 SEEDING AND MULCHING

A. General
   1. All bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched to create a protected condition. Use seed mix as indicated on the plans (if different seed mixes are indicated on the civil and landscape plans, the mix indicated on the landscape plans shall override). Critical areas shall be sodded as approved by the Engineer and as shown on the plans.
   2. Seeding and mulching shall be performed immediately upon completion of a phase or section of the Work or as approved by the Engineer.
   3. In all cases, seeding and mulching shall be performed within thirty (30) calendar days from the time the area was first disturbed.
   4. During any period of time which the soil is unprotected, provide erosion control structures as necessary to minimize erosion and to keep any eroded soils on the site and out of ditches, rivers, storm sewers and wetlands.
   5. Refer to the plans for notes regarding the use of turf reinforcement matting and/or mulch blankets (on all slope exceeding 1 vertical to 10 horizontal).

B. Seed: Seed shall be applied uniformly at a minimum rate of 48 pounds per acre.

C. Fertilizer: Fertilizer shall be applied uniformly at a minimum rate of 250 pounds per acre.

D. Mulch: Mulch shall be uniformly applied at a rate of two (2) tons per acre, or equal, on all seeded areas that have a slope of less than 1 vertical to 10 horizontal. Refer to note A5. above for additional slope stabilization requirements.

3.03 DITCH AND RIVERS

A. When reasonably possible, banks of ditches and rivers disturbed under this Work shall be protected within 24 hours of disturbance, but in no case shall banks be left unprotected more than 7 calendar days.

3.04 STEEP SLOPES

A. Emulsion
   1. On slopes greater than 10%, use erosion control blankets or turf reinforcement matting to hold seed in place. Refer to plan notes.
   2. Other methods: Chemical self-adhering mulch and other mulch anchoring methods may be used as approved by the Engineer.

3.05 SITE IMPROVEMENTS CONSTRUCTION

A. During construction of the site improvements conform to the following general rules:

1. Minimize the amount of earth disturbed at any one time.
2. Establish a construction sequence which includes adequate erosion control.
3. Provide ground cover, even if only temporary, so as to stabilize an area and minimize erosion.
4. As much as practicable, direct storm water away from the construction area. Direct diverted storm water to any stable area.
5. Collect runoff from the site in sediment basins, traps or through filters.
6. Establish an inspection and maintenance schedule, paying special attention to the beginning of the various stages of construction. Employ a certified storm water operator and keep a log of the soil erosion and sedimentation control measures in accordance with the NPDES requirements.
7. Keep in mind that the primary objective is to keep the soil on the site.
8. Once final stabilization of the site is complete, and the governing agency has granted its approval, remove all temporary erosion control structures.
9. Control site runoff during all periods of site construction to ensure that excess surface runoff does not reach adjacent properties. This is especially critical during stages when the land has been stripped but not yet graded.

3.06 CLEANING

A. Perform cleaning of all areas affected by work under this section and leave the site in a neat and tidy state. Contractor shall keep Adjacent Roads clean and free of debris.

END OF SECTION

SECTION 312000 - EARTH MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. All earthwork operations shall confirm to the current Michigan Department of Transportation standards and specifications.

C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.

2. Subbase course for concrete walks and pavements.

3. Base course for asphalt paving.

4. Excavation and backfill for utility trenches.

B. Related Sections include the following:

1. Division 311000 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

3. Division 334100 Section “Storm Sewers, Underdrains and Drainage Structures” for storm drainage system.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Engineered Fill: Fill placed and compacted to densities specified herein, in a controlled manner using lift thickness limited herein, monitored, and tested by the Testing Agency or independent Geotechnical Inspector.

G. Excavation: Removal of material encountered above subgrade elevations.

H. Fill: Soil materials used to raise existing grades.

I. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

M. Undercutting: Necessary excavation of poor quality soils which occur below the existing

Topsoil and any uncontrolled fill soils as described in the Geotechnical Investigation.

N. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Drainage fabric if required for the project .

2. Separation fabric if required for the project.

B. Test Reports: Testing Agency shall submit the following reports directly to the Engineer and shall copy the contractor:

1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.

2. In-place density test reports.

3. Moisture-density relationship test reports.

4. Compressive strength or bearing test reports.

C. Material Test Reports: Interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

A. Testing Agency Services

1. The Owner will secure and pay for the services of a qualified, independent geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Geotechnical engineer shall be acceptable to the Engineer and the owner and shall be licensed to practice in the state in which the project is located.

B. Pre-excavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer or Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer and Owner not less than three (3) calendar days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's or Owner’s written permission.

3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials without additional cost to Owner when sufficient satisfactory soil materials are not available from excavations. Contractor is responsible for doing an independent earthwork calculation and including any import of appropriate fill material required to bring the site to the proposed grades.

B. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in any dimension, trash, debris, organic material, other objectionable material and classified as follows:

1. GP (poorly graded gravel).
2. GM (silty gravel).
3. GC (clayey gravel).
4. SW (well-graded sand).
5. SP (poorly graded sand).
6. SM (silty sand).

C. Unsatisfactory Soil Material (ASTM D 2487):

1. SC (clayey sand).
2. CL (lean clay).
3. ML (silt).
4. OL (organic clay).
5. OL (organic silt).
6. CH (fat clay).
7. MH (elastic silt).
8. OH (organic clay).
9. OH (organic silt).
10. PR (peat).

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

1. Clean granular fill meeting MDOT Class II grading requirements.

2. On-site granular deposits within the excavation can be used as engineered fill if approved by the geotechnical engineer and if selective excavation procedures are employed to manage existing clay deposits.

3. Import fill as required to make-up volumes necessary to raise the building site.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Generally either an MDOT 3G, 5G, 6A, or 34R will meet this requirement. Bedding requirements of the agencies having jurisdiction over the utility installation take precedence over these specifications.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; Generally either an MDOT 6A or 34R will meet this requirement. Refer to the plans for specific requirements.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.

B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures approved by agency having jurisdiction to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 EXPLOSIVES

A. Explosives: Explosives are prohibited for use on the Project site.

3.4 EXCAVATION, GENERAL

A. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.

B. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the Engineer and the correction thereof to the satisfaction of the Engineer shall be borne by the contractor.

1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the Engineer.

2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the Engineer.

C. Approval of Subgrade: Notify the Testing Agency when required elevations have been reached.

1. When required by the Engineer due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the Engineer's or geotechnical engineer's instructions.

2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.

D. Excavation Stabilization: Slope faces of excavations to maintain stability in compliance with requirements of governing authorities. Do not use shoring and bracing where faces can be sloped.

3.5 EXCAVATION FOR STRUCTURES

A. Do not proceed with excavations for building structures until Subgrade Preparation operations are complete and tested.

B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations from 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

C. Coordinate excavations with Dewatering operations as required to allow construction of foundations to dry.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms in accordance with the plans and standard details. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade. Provide bedding course per the plan notes and/or details.

3.8 SUBGRADE PREPARATION AND INSPECTIONS

A. Perform mass earthwork operations to remove all existing topsoil and other organic materials in their entirety within the footprint of the proposed building and pavement areas. Buried objects should be removed in their entirety.

B. Notify Testing Agency when excavations have reached required subgrade elevations.

C. Proof-roll subgrade in the presence of the Testing Agency to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to the first direction. Limit vehicle speed to 3 mph.

2. Proof-roll subgrade with heavy pneumatic-tired equipment or loaded 10-wheel, tandem-axle truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Testing Agency, and replace with engineered fill as directed.

D. If Testing Agency determines that unsatisfactory soil is present, continue excavations and replace with compacted backfill or fill materials as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used at no additional cost to the Owner.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. All pipe backfill to be done according to the details shown on the plans or the requirements of the regulating agency.

C. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use engineered fill.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Behind walls, use engineered drainage fill.

6. Under footings and foundations, use engineered fill.

7. Over excavated areas, use engineered fill or lean concrete.

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within two (2) percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.15 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 88 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish Subgrades to required elevations within plus or minus 1 inch.

C. Grading Inside Grading Lines: Finish subgrade to a tolerance of ½ inch, when tested with a 10 foot straight-edge.

D. Contractor shall confirm that the proposed grades shown on the plans will not create a ponding water condition (i.e. an unintended low spot or pavement grades of less than 1%).

3.17 SUBSURFACE DRAINAGE

A. Drainage Piping: Drainage pipe is specified in Division 33 Section 4100.

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench. Place a 6 inch course of filter material on drainage fabric to support drainage pipe. Encase drainage in a minimum of 12 inches of filter material and wrap in a drainage fabric, overlapping sides and ends at least 6 inches.

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.

1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.

3.18 SUBBASE AND BASE COURSES

A. If indicated on the plans or deemed necessary by the geotechnical engineer, install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

B. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions if fabric is called for on the plan or deemed necessary by the geotechnical engineer.

C. Under pavements and walks, place base on prepared subbase or subgrade as follows:

1. Place base course material over subbase (or subgrade if subbase is not indicated).

2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

D. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layers to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

A. Under slabs-on-grade, if indicated on the plans, place drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to no less than 95 percent of maximum dry unit weight according to ASTM D 698.

2. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no more than 6 inches thick or less than 3 inches thick when compacted.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Construction Manager/Owner will engage a qualified independent Geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and to test any subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work. Comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556. ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate and remove and replace soil to depth required, recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces becomes eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Protect all existing trees, bushes, plants, etc. indicated to remain during construction activities.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Unless otherwise indicated on the drawings, remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

1. Do not burn materials on the Owner's property.

****END OF SECTION****

SECTION 313220
GEOTEXTILE FABRIC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 SCOPE

A. The work under this section shall consist of furnishing all labor, materials and equipment for the installation of the geotextile fabric.

1.3 SUBMITTALS

A. Manufacturer's Literature: Furnish to Architect, when required, copies of manufacturer's specifications, and installation instructions for geotextile fabric. Include photographs, catalogue cuts, samples as may be required to show compliance with these specifications.

PART 2 - PRODUCT

2.1 GEOTEXTILE FABRIC

A. The product shall be AMOCO CEF2006, LINQ Industrial Fabrics – GTF-300 or an approved equivalent.

B. The geotextile shall be of woven construction and consist of long-chain polymeric yarns. The yarns must be composed of at least 95% propylene or ester polymers. The fibers shall be produced in a manner which achieves a stable network. The geotextile shall conform to the mechanical and hydraulic property requirements listed below:

MINIMUM AVERAGE:

PROPERTY	VALUE	UNIT	TEST PROCEDURE
Tensile Strength	300	lbs	ASTM D-4632
Tensile Elongation	15	%	ASTM D-4632
Mullen Burst	600	psi	ASTM D 3786
Trapezoidal Tear Strength	120	lbs	ASTM D 4533
Puncture Strength	120	lbs	ASTM D 4833
Apparent Opening Size (max)	0.210	mm	ASTM D 4751
Permittivity	0.05	1/sec	ASTM D 4491

PART 3 - EXECUTION

3.1 INSTALLATION

A. The geotextile fabric shall be furnished and stored in a wrap which will protect the geotextile fabric from ultraviolet radiation and abrasion. The geotextile fabric shall be covered with the appropriate soil cover within two weeks of its placement.

B. Should the geotextile fabric be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is sufficiently large enough to cover the damaged area plus two feet (2') of adjacent undamaged geotextile fabric in all directions.

C. Fabric shall be installed on dry soil as per manufacturer.

D. Overlap the fabric as recommended by the manufacturer.

E. Installation and Unit Price shall include overlap quantities.

END OF SECTION 323220

SECTION 321216 – HOT-MIX ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.02 SUMMARY

A. This Section includes installation of the following:
   1. Hot-mix asphalt concrete paving.

B. Related Sections include the following:
   1. Division 311415 Section "Pavement Marking."
   2. Division 312000 Section "Earth Moving" for subgrade preparation, grading and subbase course.

1.03 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. MDOT: Michigan Department of Transportation.

1.04 REQUIREMENTS

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of MDOT'S most current Standard Specifications for Construction. Where notes in this specification section differ from the MDOT standards, the MDOT standards shall govern.

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

C. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

1.05 SUBMITTALS

A. Submit aggregate and bituminous mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.
   1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with (MDOT) Michigan Department of Transportation's current Standard Specification for Construction for asphalt paving work.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
   1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
   2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Apply pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: ASTM D 946.

B. Aggregate for Base Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

C. Aggregate for Leveling Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

D. Aggregate for Wearing Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

E. Fine Aggregate: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

F. Mineral Filler: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

G. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

B. Asphalt Cement: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

C. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

D. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.03 AUXILIARY MATERIALS

A. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

B. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.

C. Pavement-Marking Paint: Refer to section 32 1415 "Pavement Marking".
   1. Color: As indicated on Drawings or in accordance with MDOT.

D. Wheel Stops (if indicated): Precast, air-entrained concrete, 2500-psi minimum compressive strength, 6 inches high by 9 inches wide by 84 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.04 ASPHALT MIX DESIGNS

A. Hot-Mix Asphalt: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Proof-roll as indicated in "Earth Moving" section 31 2000.

C. Verify that gradients and elevation of base are correct. Retain first subparagraph below, if applicable.

3.02 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch minimum or as indicated.
   1. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared compacted subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

3.04 HOT-MIX ASPHALT CONCRETE PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at minimum temperature of 250 deg F.
   4. Install work in accordance with Michigan Department of Transportation (MDOT).
   5. Compact pavement by rolling to density specified. Re-roll as necessary to achieve even and smooth finish without roller marks.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

3.06 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Minimum Density: 97 percent of reference laboratory maximum theoretical density according to AASHTO T 245.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Confirm minimum 1% slopes on asphalt pavement surfaces. Notify engineer prior to asphalt placement if minimum 1% slope is not met in any areas.

3.08 PAVEMENT MARKING

A. Refer to specification section 321415 “Pavement Marking”.

3.09 FIELD QUALITY CONTROL

A. Testing and inspecting: Owner may secure a testing firm to perform and determine compliance with specified requirements and AI MS-2.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

SECTION 321313 – CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.02 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Driveways and roadways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Sidewalks and platforms.
   5. Wheel stops.

B. Related Sections include the following:
   1. Division 311415 Section "Pavement Marking."
   2. Division 312000 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.03 PERFORMANCE REQUIREMENTS

A. Refer to MDOT's current Standard Specifications for Construction.

1.04 SUBMITTALS

A. Submit aggregate and concrete mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer with at least three (3) years in business who has completed pavement work similar in material, design, and extent to that indicated for this Project.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

1. Manufacturers must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Do not place concrete when base is wet or frozen. Protect concrete pavement from damage by rain or inclement weather.

C. Protect the concrete from freezing until it attains a compressive strength of at least 1,000 PSI. Do not place concrete pavement until the ambient air temperature away from artificial heat is at least 25 degrees Fahrenheit and rising. At the time of concrete placement, ensure a concrete temperature from 45 degrees Fahrenheit to 90 degrees Fahrenheit.

PART 2 PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curved conditions.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces.

2.02 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated flat sheets, unfinished.

B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed billet steel, unfinished.

C. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.

D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.

G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

J. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.03 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project. All material to meet current MDOT specifications.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry were indicated on Contract Documents.

B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

C. White Membrane Curing Compound: ASTM C 309, Type 2.

2.05 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
   1. Thickness: ½ inch minimum and thicker where indicated.

B. Coloring Agent: Where indicated, ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
   1. Color: n/a

C. Wheel Stops (use only if indicated on the plans): Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside and provide holes for dowel-anchoring to substrate.
   1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 18 inches.

D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

E. Bonding Agent: ASTM C 1059, Type II, non-redispersal, acrylic emulsion, or styrene butadiene.

F. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.06 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

C. Concrete mix design shall meet the requirements of MDOT Concrete Grade P1, with compressive strength, maximum water-cementitious materials ratio, slump limit, and air content per MDOT specifications. The maximum aggregate size in coarse aggregate gradation shall be 1.5 inches.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 8.5 percent.

F. Use appropriate treatment per MDOT specifications where concrete will be placed under freezing conditions. Obtain approval of Engineer prior to placing concrete in freezing conditions. Concrete accelerators may be used in cold temperatures as noted below:
   1. In concrete with steel reinforcement, a non-chloride accelerating admixture may be used. Admixture product shall be approved by MDOT per their current Qualified Products List (QPL) and the dosage shall be per manufacturer’s instructions. Admixtures containing calcium chloride shall not be used in concrete containing steel reinforcement.
   2. In concrete without steel reinforcement, calcium chloride concrete accelerators may be used and shall meet the requirements of MDOT Specification Section 903.04.

G. Coloring Agent: Where indicated, add coloring agent to mix according to manufacturer's written instructions.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
   1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 EXECUTION

3.01 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction and repair as required.

B. Verify that grades are correct.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

C. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. At all locations where new concrete abuts existing concrete, building wall, or supported slabs, place expansion joint and joint sealant.

C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where required.

1. Terminate joint filler 1 inch below finished surface to allow placement of joint sealant.

2. Joint sealant is required for all projects even if not indicated on the plans.

E. Expansion Joints: Place 1 inch (25 mm) wide expansion joints at maximum 40 foot intervals, if not indicated on drawings. Joints to be full depth of pavement. Place joint sealant at all expansion joints.

F. Install dowel bars and support assemblies at joints if indicated on the plans. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas. Construct ¼ inch wide contraction joints for a depth equal to at least one-third of the concrete thickness. Maximum spacing of contractions joints shall be 8'.

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

H. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius.

1. Radius: 3/8 inch (10 mm).

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

E. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

3.06 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots.
   1. Area Paving: Light broom, texture perpendicular to pavement direction.
   2. Curbs and Gutters: Light broom, texture parallel to pavement direction.
   3. Direction of Texturing: Parallel to pavement direction.
   4. Inclined Vehicular Ramps: Heavy broomed perpendicular to slope.
   5. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

C. Provide detectable warning surface at all handicap ramps to meet ADA requirements in accordance with ANSI sections 406.13 and 705.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions.

C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.

3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation Variation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface Variation: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
   4. Maximum cross slope for walks, ramps, platforms: 2%
   5. Maximum longitudinal walk slopes not requiring landings and handrails: 5%

6. Maximum longitudinal ramp slopes: 8.33% (1 on 12 slope)

3.09 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. If indicated on the plans, spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified.

B. Testing Services: Testing shall be performed according to the following requirements:

1. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
2. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.

C. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements as directed by the Engineer.

B. Remove and replace concrete sidewalks and/or ramps that do not comply with maximum slopes indicated in Section 3.8A above.

C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) calendar days after placement.

END OF SECTION

SECTION 321373 – CONCRETE PAVING JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.02 SUMMARY

A. General – all expansion joints are to receive joint sealant. Contraction and other joints receive sealant only if indicated on the plan.

B. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

C. Related Sections include the following:
   1. Division 321216 Section "Hot-Mix Asphalt Concrete Paving" for constructing joints between concrete and asphalt pavement.
   2. Division 321313 Section "Cement Concrete Pavements, Curbs and Gutters" for constructing joints in concrete pavement.

1.03 SUBMITTALS

A. Product Data and shop drawing submittals are not required. The contractor shall confirm that the materials provided meet the required specifications and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet or covered with frost.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Use products meeting MDOT's current specifications.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: Gray.

2.03 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone.
      b. Dow Corning Corporation; 888.
      c. Approved equal.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone SL.
      b. Dow Corning Corporation; 890-SL.
      c. Approved equal.

2.04 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
   1. Products:
      a. Crafco Inc.; Superseal 444/777.

b. Meadows, W. R., Inc.; Poly-Jet 3406.
c. Approved equal.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.
1. Products:
a. Koch Materials Company; Product No. 9005.
b. Koch Materials Company; Product No. 9030.
c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
d. Approved equal.

2.05 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.06 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior

experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 321415 – PAVEMENT MARKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.

B. These specifications apply to private, on-site pavement marking. All pavement markings within public rights-of-way must comply with the standards of the regulating agency.

1.02 SUMMARY

A. The work under this section includes but is not necessarily limited to the furnishing and installation of all materials necessary for placing pavement markings as indicated on drawings and specifications.
   1. Markings on concrete pavement areas.
   2. Markings on asphalt pavement areas.
   3. Markings on existing concrete or asphalt areas.
   4. Markings on resurfaced existing pavements.

B. Related Sections include the following:
   1. Division 321216 Section "Hot-Mix Asphalt Concrete Paving."
   2. Division 321313 Section "Cement Concrete Pavements, Curbs and Gutters."

1.03 QUALITY ASSURANCE

A. MDOT Specifications: Unless otherwise indicated on drawings or herein specification, all work under this section shall be performed in accordance with the current MDOT Standard Specifications for Highway Construction.

B. Physically Handicapped: All marking shall be done in accordance with ADA Requirements.

C. Paint Containers: Each paint container shall be plainly marked, with a durable, weather-resistant marking, showing the name and address of manufacturer or vendor, description of material, batch number, date of packaging and volume and weight of contents.

D. Use only personnel completely trained and experienced in installation of materials and equipment.

1.04 SUBMITTALS

A. Product Data and shop drawing submittals are not required. The contractor shall confirm that the materials provided meet the required specifications and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to owner.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials and products for work under this section shall conform to current 1990 MDOT Standard Specifications for Highway Construction.

2.02 PAVEMENT MARKING PAINT

A. The parking and/or traffic lane marking paint shall have a chlorinated rubber base. The paint shall be factory mixed, quick drying and non-bleeding. FS TT-P-115C Type III.
   1. FS TT-P-1952 – Paint, Traffic Black, and Airfield Marking, Waterborne; Rev/ E, 2007
   2. FHWA MUTCD – Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Dept of Transportation, Federal Highway Administration; http://mutcd.fhwa.dot.gov; current edition

B. Manufacturers
   1. Sherwin Williams
   2. SealMaster

C. Colors
   1. Parking lot striping shall be painted yellow.
   2. Traffic land and traffic movement markings shall be painted yellow.
   3. Barrier free parking spaces and access aisles shall be painted barrier free blue.
   4. Barrier free curb cut/dub-downs shall be painted barrier free blue.
   5. Fire lane markings shall be painted red.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to all the work of this section, carefully inspect installed work of all trades and verify all such work is complete to the point where installation may properly commence. Verify all pavement markings may be installed in accordance with all pertinent codes and regulations, authorities having jurisdiction and referenced standards.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancies until all has been fully resolved.

3.02 SURFACE PREPARATION

A. Cleaning: Prior to application of pavement marking, it shall be marking contractor's responsibility that pavement surfaces are clear, dry and free of all foreign materials.

B. New pavement curing new bituminous wearing surface shall be in place for period of not less than fourteen days prior to application of Fast Dry pavement markings.

3.03 CONSTRUCTION METHODS

A. Application: Pavement markings shall be solid 4" wide yellow lines and laid out as indicated on drawings. Paint shall be applied uniformly at a minimum rate of sixteen gallons per mile for a single 4" solid line. Markings shall be applied so that they adhere adequately to the surface.

B. Protection of wet paint shall be the responsibility of the contractor. Markings obliterated by traffic shall be retraced at the contractor's expense.

3.04 DEFECTIVE WORK

A. Improper location: Improperly located markings shall be removed at contractor's expense in a manner acceptable to Engineer and reapplied in correct locations at contractor's expense.

B. Material shortage: Markings which are applied with material shortages shall be properly reapplied at the contractor's expense.

3.05 CLEAN UP

A. Upon completion of the work of this section, remove all rubbish, trash and debris resulting from the work of this section. Leave the site in neat and orderly condition.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: 72 inches.
2. Light-Industrial-Strength Material: Group IC-L, round steel pipe, electric-resistance-welded pipe.

    a. Line Post: 2.375 inches in diameter.
    b. End, Corner, and Pull Posts: 2.875 inches.

3. Horizontal Framework Members: Intermediate, top and bottom rails according to ASTM F 1043.

    a. Top Rail: 1.66 inches in diameter.

4. Brace Rails: ASTM F 1043.
5. Metallic Coating for Steel Framework:

    a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123 or 4.0-oz./sq. ft. zinc coating according to ASTM A 653.
    b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
    c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
    d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
    e. Coatings: Any coating above.

6. Polymer coating over metallic coating.

    a. Color: Black, according to ASTM F 934.

2.2 SWING GATES

A. General: Comply with ASTM F 900 for the following swing-gate types:
1. Single gate.
2. Double gate.

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

1. Steel Pipe Sizes: Refer to plan detail for sizes

C. Metal Pipe and Tubing: Aluminum. Comply with ASTM B 429 and ASTM F 1043 for materials and protective coatings.
   1. Frames and Bracing: Fabricate members from round tubing with outside dimension and weight according to ASTM F 900.
   2. Aluminum Pipe Sizes: Refer to plan detail for sizes.

D. Frame Corner Construction: As follows:

   1. Welded or assembled with corner fittings and 5/16-inch (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900.

F. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following: Latches permitting operation from both sides of gate, hinges, center gate stops and, for each gate leaf more than 5 feet (1.5 m) wide, keepers. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.3 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.

   1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

   1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

a. Polymer coating over metallic coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.

D. Line Posts: Space line posts uniformly at 96 inches o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts

with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

L. Privacy Fabric Screen: Install fabric screen, securely fastened in place.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 32 3113

SECTION 329200 - TURFS AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.

2. Turf Renovation.

3. Sodding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.

2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

3. Division 32 Section “Fine Grading” for final grades for planting.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Certification of Bio-Retention Area Seed: From seed vendor for each bio-retention-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Product Certificates: For fertilizers, signed by product manufacturer.

E. Qualification Data: For landscape Installer.

F. Material Test Reports: For imported topsoil.

G. Planting Schedule: Indicating anticipated planting dates for each type of planting.

H. Maintenance Instructions: Recommended procedures to be established by Contractor for the Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; location exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1st and June 1st.

2. Fall Planting: September 15th and October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

b. A minimum of two (2) lawn cuttings (MANICURED LAWN ZONES ONLY) will be completed before the owner takes over maintenance.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water lawn at a minimum rate of 1 inch per week.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow grass to 2 inches height.

E. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Apply Type B fertilizer to lawns approximately 30 days after seeding

at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft.

(140 lbs./acre). Apply with a mechanical rotary or drop type distributor.

Thoroughly water into soil. (Provide 3 applications)

F. Weed Control: If an infestation of weeds or crab grass develops prior to acceptance of the lawn, the Contractor shall treat the infestation by hand weeding or chemical control. The chemical control shall be furnished and installed by the contractor as recommended by the manufacturer and approved by the Landscape Architect. At least two weeks shall elapse after chemical control is applied before a request or inspection for acceptance is made to the Landscape Architect.

G. Apply fungicides and insecticides as required to control diseases and insects.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed shall be provided from one of the following suppliers

1. Lesco (248) 689-5005

2. Rhino Seed & Supply (800) 482-3130

3. Michigan State Seed Solutions (800) 647-8873

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. General Seeded Lawn Areas (for lawn restoration areas only):

   a. 50 percent Kentucky Bluegrass, a minimum of (3) three cultivars

   b. 50 percent Perennial Ryegrass, a minimum of (2 or 3) two or three cultivars.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

   1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars

2.3 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

   1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

   1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.7 FERTILIZER

A. Granular, non-burning product composed of not less than 50% organic

slow acting, guaranteed analysis professional fertilizer.

1. Type A: Starter fertilizer containing 11% nitrogen, 23%

phosphoric acid, and 10% potash by weight or similar approved

composition.

2. Type B: Top dressing fertilizer containing 31% nitrogen, 3%

phosphoric acid, and 10% potash by weight or similar approved

composition.

a. Apply Type A fertilizer at initial sowing of seed and a Type B fertilizer application 4 weeks after initial germination.

b. (Provide a min. one (1) Type A fertilizer application and three (3) Type B fertilizer applications)

2.8 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.9 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.10 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments in the following quantities:

PLANTING BEDS:

1. Three parts well-drained screened organic imported topsoil to one part clean imported sand to one part Canadian sphagnum peat moss, to one part natural compost (weed-free).

LAWNS:

2. Manicured Lawns shall use screened stock-piled topsoil from specified on-site location.

2.11 SEEDING

A. General: Provide grasses for seeding.

2.12 MATERIALS

A. Topsoil for Seeding Lawn Areas.

B. Seed: Fresh, clean and new crop seed mixture. Mixed by approved methods.

C. Composed of the following varieties, mixed to the specified proportions by weight and tested to minimum percentages of purity and germination.

D. Seed Mixture: Proportioned by weight as indicated below:

1. Lawns

MDOT Mix THM	Proportion	Minimum Purity	Minimum Germination
Kentucky Bluegrass	30%	98%	85%
Creeping Red Fescue	50%	97%	85%
Perennial Ryegrass	20%	96%	85%

a. Spread at a rate of 220 lbs./acre

b. No noxious weed seeds permitted.

E. Fertilizer: 13-25-12. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis, professional fertilizer.

F. Ground Limestone: Used if required by soil test report. Containing not less than 85% of total carbonates and ground to such fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20% mesh sieve.

G. Granulated sulfur 0-0-0-90 to lower pH. Use if determined by soil tests to be necessary. Apply per soil test recommendations at specified rate.

H. Straw Mulch: Used in crimping process only. Clean oat or wheat straw well seasoned before bailing, free from mature seed-bearing stalks or roots of prohibited or noxious weeds.

I. Water: Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by Contractor. Test for excess Alkalinity, if necessary.

J. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable to hydra-mulching.

1. AVAILABLE MANUFACTURER AND TYPE:

2. CONWED HYDROMULCH: CONWED CORP., ST. PAUL, MN

3. CELLIN HYDROMULCH: CELLIN MFG. INC., LORTON, VA

K. Paper Mulch: Degradable paper mulch, free of foreign debris. Do not use on slopes over 30%. Available manufacturer and type NU Wool Hydro Mulch, Jennison, MI.

L. Tackifier: Liquid concentrate diluted with water forming a transparent 3-dimensional film like crust permeable to water and air and containing no agents toxic to seed germination.

1. AVAILABLE MANUFACTURER AND TYPE:

2. FINN HYDROSTIK, FAIRFIELD, OH

3. POLYING DLR: CELITE INC., CLEVELAND, OH

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydro-seeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

b. Mix lime with dry soil before mixing fertilizer.

2. Spread lawn planting soil mix to a depth of 3 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least of 6 inches.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/4 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the rate of 220 lb/acre as indicated per specified seed mix.

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh and 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.

3.6 TURF RENOVATION

A. Renovate existing lawn.

B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.

C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.

D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

E. Mow, dethatch, core aerate, and rake existing lawn.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new lawns.

K. Water newly planted areas and keep moist until new lawn is established.

3.7 MULCHING

A. Place straw mulch on seeded areas within twenty-four (24) hours after seeding.

B. Place straw mulch uniformly in a continuous blanket at a rate of 2-1/2 tons per acre or two (2) 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Engineer.

C. Crimp straw into soil by use of a “crimper.” Two (2) passes in opposite direction required.

3.8 SLIT SEEDING (OPTIONAL METHOD)

A. Lawn to be professionally slit seeded by using equipment designed for this purpose. Recommended brands: Brillant, Jacobsen or Olathe.

3.9 HYDROSEEDING (OPTIONAL METHOD)

A. Use a hydromulcher (sprayer) and apply mixture(s) at the following rate. Mix in accordance with manufacturer’s recommendations.

B. Apply hydroseed slurry to indicated areas. Use tackifier only on erosion prone areas. Apply fertilizer with hydro mix.

Seed:	At specified seeding rates (300 pounds per acre)
Fertilizer:	400 pounds per acre
Tackifier:	60 gallons per acre
Wood Cellulose Fiber Mulch:	2000 pounds per acre

C. Care must be taken not to get hydroseed materials on buildings, walks, roadways, plant beds, etc.

3.10 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 4 by 4 inches.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION

SECTION 329410
ENGINEERED WOOD FIBER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

B. All products supplied shall submit certification that material meets the current Consumer Product Safety Commission and ADA requirements.

1.2 SCOPE

A. The work under this section shall consist of furnishing all labor, materials and equipment to for the installation of an engineered wood fiber bark mulch in accordance to the drawings and specifications.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM F1951 – Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
   b. ASTM F1292 – Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment
   c. ASTM F2075 – Standard Specification for Engineered Wood Fiber for use as a Playground Safety Surface Under or Around Playground Equipment.

1.4 SUBMITTALS

A. Manufacturer's Literature: Furnish to Architect, when required and copies of manufacturer's specifications. Include photographs, catalogue cuts, samples as may be required to show compliance with these specifications.

B. Testing Data Relating to the Following:

1. Critical height based on ASTM F1292 impact attenuation testing
2. Minimum fill-depth data
3. Toxicity
4. ADA/ABA accessibility guidelines for firmness and stability based on ASTM F1951.

PART 2 - PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A.	Sof Fall	Manufactured by:	Sof Fall Ashton, Idaho 800-523-8690 (Elouise)
B.	CushionWood	Manufactured by:	Kamps Wood Resources Grand Rapids MI 49504 616 453-1986
C.	Safe Site System	Manufactured by:	Safe Site Systems Cincinnati, OH 45248
D.	WoodCarpet	Manufactured by:	Zeager Bros. Inc. Middletown, PA 17057-9954 800-346-8524
E.	Fibar Systems	Manufactured by:	Fibar Group Mamaroneck N.Y 800-342-2721

PART 3 - EXECUTION

3.1 INSTALLATION

A. The bark mulch shall be furnished and installed as per the details and manufacturers recommendations.

END OF SECTION 329410

SECTION 331100 – WATER MAIN

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Where these specifications differ from the standard details or specifications of the governing agency, the agency standards shall apply.

B. Materials and installation requirements are generally indicated on the plans. Materials indicated in these specifications only apply if indicated on the plans and allowed by the regulating authority. The contractor is responsible for confirming allowable materials and installation requirements with the regulating authority and including these requirements in their bid.

C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.02 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for the water supply system (for both fire protection and domestic water systems).

B. Water meters may be provided by the regulating authority. The contractor shall confirm with the regulating authority and pay the required fees for the meter.

1.03 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber

B. HDPE: High density polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

D. DI: Ductile Iron.

1.04 SUBMITTALS

A. Product Data and shop drawing submittals are not required. The contractor shall confirm that the materials provided meet the requirements of the regulating authority, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of utility company supplying water, including materials, installation, tapping of water mains, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
   1. Notify construction manager (or architect if there is no construction manager) no fewer than three days in advance of proposed interruption of service.
   2. Do not proceed with interruption of water-distribution service without construction manager's or architect's written permission.

1.08 COORDINATION

A. Coordinate connection to water main with utility company and make connection per their requirements.

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:
   a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
   b. NPS 2-1/2 (DN 65) Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
   a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
   b. NPS 2-1/2 (DN 65): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances:
   a. Available Manufacturers: Subject to compliance with requirements of regulating authority.
   b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

c. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gaskets suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.03 PE PIPE AND FITTINGS (USE ONLY IF INDICATED ON THE DRAWINGS AND ALLOWED BY THE REGULATING AUTHORITY).

A. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psi.
   1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
   2. Molded Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.

B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psi.
   1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psig.

2.04 PVC PIPE AND FITTINGS (USE ONLY IF INDICATED ON THE DRAWINGS AND ALLOWED BY THE REGULATING AUTHORITY)

A. PVC, Schedule 80 Pipe: ASTM D 1785.
   1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

B. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Gaskets: AWWA C111, rubber.
   5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.05 CORROSION- PROTECTION PIPING ENCASEMENT (USE ONLY IF SPECIFIED ON THE PLANS OR REQUIRED BY THE REGULATING AUTHORITY)

A. Encasement for Underground Metal Piping:
   1. Standards: ASTM A 674 or AWWA C105.
   2. Form: Sheet or tube.
   3. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
   4. Color: Black

2.06 GATE VALVES

A. AWWA, Gate Valves:
   1. Available Manufacturers: Subject to compliance with requirements of the regulating authority.
   2. Stem (rising or non-rising), and Gate Valve seating (metal seated or resilient seated) to meet requirements of the regulating authority and/or as shown on the standard detail sheets included with the plan.

2.07 GATE VALVE

A. Tapping-Sleeve Assemblies:
   1. Available Manufacturers: Subject to compliance with requirements of the regulating authority.
   2. Description: Sleeve and valve compatible with drilling machine.
      a. Standard: MSS SP-60.
      b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
      c. Valve: per requirements of regulating authority.

B. Valve Boxes: If requirements are not indicated on the plans or standard detail sheets, comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.
   1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts (only if indicated on the plan or required by the regulating authority): UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.08 WATER METERS

A. The water meters will be furnished by the utility company. The contractor is responsible for paying the cost of the water meter.

2.09 FIRE HYDRANTS

A. Fire Hydrants:

1. Available Manufacturers: Subject to compliance with requirements of the regulating authority or as indicated on the standard detail sheets.

2.10 FIRE DEPARTMENT CONNECTIONS

A. General– this section only applies if free standing fire department connections (FDC) are indicated on the plans. All building mounted FDC will be part of the plumbing specifications.
   1. Available Manufacturers: Subject to compliance with requirements of the regulating authority.

PART 3 EXECUTION

3.01 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications and in accordance with the regulating authority. Where these specifications differ from the requirements of the regulating authority, those requirements shall govern.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping [NPS 3/4 to NPS 2 1/2] shall be the following:
   1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings.

F. Underground water main piping [NPS 4 to NPS 16] shall be as indicated in the plans and standard detail sheets, and as allowed by the regulating authority.

3.03 VALVE APPLICATIONS

A. General Application: As indicated in the plans and standard detail sheets, and as allowed by the regulating authority.

3.04 PIPPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated. Coordinate with the water utility company to provide necessary inspection of watermain installation.

B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105 if indicated on the plans or if required by the regulating authority. The contractor is responsible for confirming this requirement and including this cost as necessary.

C. Install PE pipe according to ASTM D 2774 and ASTM F 645.

D. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

E. Install fiberglass AWWA pipe according to AWWA M45.

F. Bury piping with a depth of cover over top at least 60 inches but not less than the minimum required by the regulating authority.

G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed. These locations will be indicated on the plans; however, the contractor can propose this installation method in areas where it would be beneficial to minimize disturbance to existing conditions.

H. Extend water-service piping inside building wall and stub at 12" above floor elevation at the location dictated on the mechanical plans. Coordinate with the interior plumbing plans and the construction manager, owner, or general contractor to confirm this location.
   1. Terminate piping with caps, plugs, or flanges as required for piping material. Connections to building-water-piping systems will be made by the interior plumbing contractor.

I. Install underground piping with restrained joints and/or thrust blocks at horizontal and vertical changes in direction (as indicated on the standard detail sheets or as required by the regulating authority). Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.05 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
   1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
   2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
   3. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
   4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
   5. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
   6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.06 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following (as long as the regulating authority approves of their use):

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for all piping systems.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 VAVLE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box unless gate well is indicated on the plan.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

3.08 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position. Follow the standard details included with the plans and/or the requirements of the regulating authority.

3.09 FIRE DEPARTMENT CONNECTION INSTALLATION

A. For external FDC, install protective pipe bollards on three sides of each fire department connection if located closer than 5’ from a driveway.

3.10 CONNECTIONS

A. Connect water-distribution piping to existing water main. Use the connection method indicated on the plan and as dictated by the regulating authority.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests according to requirements of the regulating authority. If testing methods are not dictated by the regulating authority, test as follows: Conduct tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.12 IDENTIFICATION

A. If required by the regulating authority, install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.13 CLEANING

A. Clean and disinfect water-distribution piping in accordance with the requirements of the regulating authority. When requirements are not given clean and disinfect as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 333100 – SITE SANITARY SEWERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Where these specifications differ from the standard details or specifications of the governing agency, the agency standards shall apply.

B. Materials and installation requirements are generally indicated on the plans. Materials indicated in these specifications only apply if indicated on the plans and allowed by the regulating authority. Contractor is responsible for confirming allowable materials and installation requirements with the regulating authority and including these requirements in their bid.

C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.02 SUMMARY

A. This Section includes gravity-flow, non-pressure sanitary sewerage outside the building, with the following components:
   1. Cleanouts.
   2. Corrosion-protection piping encasement.
   3. Precast concrete manholes.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

A. Product Data and shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the requirements of the regulating authority, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

B. Field quality-control test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without written permission.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection.
   1. Available Manufacturers: Subject to compliance with requirements of the regulating authority.

2.02 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Materials are generally indicated on the plans. Materials indicated in these specifications only apply if indicated on the plans and allowed by the regulating authority. Contractor is responsible for confirming allowable materials and installation requirements with the regulating authority and including these requirements in their bid.

2.03 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.
   1. NPS 3 to NPS 6: SDR 23.5.
   2. NPS 8 to NPS 12: SDR 35.
   3. Gaskets: ASTM F 477, elastomeric seals.

2.04 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.05 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, with groove and tongue ends for gasketed joints with ASTM C 443, rubber gaskets.

2.06 CLEANOUTS

A. Gray-Iron Cleanouts: Use in pavement areas. ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification: Heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.07 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints. Refer to plans for standard detail.

2.08 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 1 percent through manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 8 percent

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.09 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Manufacturers:
      a. Josam Company.
      b. MIFAB Manufacturing Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Wade Div.; Tyler Pipe.
      e. Watts Industries, Inc.
      f. Watts Industries, Inc.; Enpoco, Inc. Div.
      g. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
   2. Top-Loading Classification: Heavy duty.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
   1. Manufacturers:
      a. Canplas Inc.
      b. IPS Corporation.
      c. NDS Inc.
      d. Plastic Oddities, Inc.
      e. Sioux Chief Manufacturing Company, Inc.
      f. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING APPLICATIONS

A. Gravity-Flow, Non-pressure Sewer Piping: Pipe material is indicated on the plans. Use only pipe materials indicated on the plans and acceptable to the regulating authority.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, nonpressure, sewer piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated on the drawings.
   2. Install piping at depths indicated on the plans.
   3. Install piping below frost line.
   4. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
   5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
   6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
   7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.04 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non-pressure, piping according to the following:
   1. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
   2. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
   3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
   4. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   5. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
   6. Join dissimilar pipe materials with non-pressure-type, flexible couplings.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops of manholes in lawn areas to the rim elevations indicated on the plan.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade.
   1. Use light-duty, top-loading classification cleanouts in earth areas.
   2. Use heavy-duty, top-loading classification cleanouts in paved areas.

B. Set with tops one inch above surrounding grade in non-paved areas.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.08 CONNECTIONS

A. Extend sewer piping to within 5' of building. Connection to building piping will be made by the plumbing contractor.

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.09 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Fill with flowable grout prior to enclosing if indicated on the plans. Include closures

strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use procedure indicated on the plans.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes only if required by the regulating authority.

1. Use detectable warning tape over piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Test new piping system according to requirements of regulating authority and provide test reports as required. If a testing method is not specified, test as follows:

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
b. Close openings in system and fill with water.
c. Purge air and refill with water.
d. Disconnect water supply.
e. Test and inspect joints for leaks.
f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
   b. Option: Test concrete gravity sewer piping according to ASTM C 924.

D. Leaks and loss in test pressure constitute defects that must be repaired.

E. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

SECTION 334100 – STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section. Where these specifications differ from the local or City's standard detail sheets, the detail sheets shall govern.

1.02 SUMMARY

A. The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all storm sewers, underdrains and drainage structures and leads and connections as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this Work for foundations and under slab areas. Contractor shall note that new manholes and catch basins are not intended to be part of the project, but these specifications are provided in the event that any structures need replacement.

1. Storm Sewer Pipe
2. Perforated Underdrain Pipe
3. Castings
4. Manhole Sections and Steps
5. Catch Basin
6. Brick and Concrete Block Masonry

B. Related Sections may include, but not be limited to, the following:

1. Division 31 2000 Section "Earth Moving" for excavation and backfill.

1.03 QUALITY ASSURANCE

A. Use only personnel completely trained and experienced in installation of the materials.

B. Compliance to City/Township Codes and all other agencies having jurisdiction shall govern material and installation procedures.

1.04 SUBMITTALS

A. Shop Drawings: Shop drawing submittals are not required for storm sewer materials. Contractor is expected to conform to the plans, specifications, and details for this work. Submit material certificates in lieu of shop drawings. Material certificates shall be signed by manufacturer and contractor certifying that each material item complies with or exceeds requirements.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials before, during and after installation.

B. Replacements: In the event of damage, immediately make all necessary repairs and replacements acceptable to the Engineer and at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 STORM SEWER PIPE

A. General: Storm sewer pipe material shall be as indicated on the plans. If indicated on the plans, pipe materials shall conform to the following requirements.

B. Reinforced Concrete Pipe
   1. Reinforced concrete pipe shall conform to ASTM C-76.72A, Type III & Type IV.
   2. Joints shall be premium rubber joint as acceptable to the Engineer unless otherwise specified on the drawings.

C. Corrugated Polyethelene Tubing (CPT)
   1. Corrugated Polyethelene Tubing (CPT) shall conform to ASTM F405 and shall be perforated with sock where indicated on the plans.
   2. Joints shall be secured with a factory made snap-on or screen-on coupler for 4" and 6" diameter. Joints for 8" diameter and larger shall be a factory made coupler ties, bolts or screws on.

D. Smooth Lined Corrugated Polyethylene Pipe (SLCPP)
   1. Corrugated polyethylene pipe shall have a smooth interior wall, Manning's "n" of 0.012 or better and shall conform to AASHTO M294.
   2. Joints shall be secured with a tied or bolted polyethylene coupler or shall be a factory made coupler which can be screw turned on to the end corrugations.
   3. Corrugated polyethylene pipe shall be Advanced Drainage Systems N-12, Hancor HiQ or accepted equal.

2.02 PERFORATED UNDERDRAIN PIPE (PE OR CPP)

A. General
   1. Perforated underdrain pipe shall be perforated, corrugated polyethelene pipe.
   2. The pipe shall have a factory installed geotextile pipe wrap.
   3. Perforation shall meet the requirements of AASHTO M 278.

B. Polyethylene Pipe (PE): Polyethylene pipe and fittings shall be standard strength and conform to ASTM F 405 and AASHTO M 252.

C. Polyvinyl Chloride Pipe (PVC): Polyvinyl Chloride pipe and fitting shall be standard strength and conform to ASTM F 800.

D. Geotextile Pipe Wrap: Geotextile pipe wrap shall weigh at least 3.5 ounces per square yard and shall conform to AASHTO M 288. It shall not be ripped or torn. The minimum tensile strength shall be 100 pounds.

2.03 CASTINGS

A. General: All castings shall be of cast iron, conforming to ASTM A 48 unless otherwise indicated. Conform to details and notes indicated on the plans. Where details or notes are not indicated, conform with the following requirements.

B. Manhole frames and covers: Material shall be MDOT Type A with perforated covers.

C. Catch basins and inlet castings: Catch basin and inlet castings shall be MDOT Type K when located in curbs and gutter, MDOT Type E in non-paved locations, and MDOT Type A when located in paved areas.

2.04 MANHOLE SECTIONS

A. Manhole walls
   1. Standard manhole walls shall be Precast concrete units conforming to ASTM C 478, or be concrete block masonry.

B. Manhole bases: Manhole bases shall be precast concrete units of the dimensions indicated on the Drawings.

2.05 MANHOLE STEPS

A. Manhole steps shall be of cast iron conforming to ASTM A 48 or equal, and shall meet pertinent safety rules and regulations.

2.06 CATCH BASINS

A. Construct catch basins of brick, block, masonry, or Precast units. Precast concrete catch basin units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.07 INLETS

A. Construct inlets of brick, block, masonry, or Precast units. Precast inlet units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.08 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.09 MORTAR

A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand.

2.10 BRICK

A. Brick Work shall meet the requirements of Medium Brick of ASTM C 13.

2.11 CONCRETE BLOCK MASONRY

A. Concrete block masonry shall conform to ASTM C 139.

2.12 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and as selected by the Contractor subject to review by the Engineer.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection
   1. Verify that all work under this Section may be installed in accordance with all pertinent codes and regulations, the original design and the reference standards.
   2. All materials shall be inspected immediately before installation, and if found defective, immediately removed from the site.

B. Discrepancies
   1. In the event of discrepancy, immediately notify the Engineer.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 EARTHWORK

A. All earthwork required for the performance of the work of this Section shall be installed in accordance with Division 31 2000 Section “Earth Moving.”

3.03 INSTALLATION

A. General: Install all pipe and fittings in strict accordance with the manufacturer's recommendations as acceptable to the Engineer and other authorities having jurisdiction.

B. Handling
   1. Distribute pipe and materials at the site as required, care to prevent damage to the pipe and materials.
   2. Use proper tools and implements for safely handling and installing the pipe and other materials.
   3. Protect the pipe and other materials from falling to the ground or into the trench.
   4. Protect distributed pipe and materials from the public and passing vehicles.

C. Laying pipe

1. Lay all pipe true to line and grade with pipe ends abutting each other and the bell end facing the direction of laying.
2. Use laser alignment equipment to establish and maintain proper line and grade, unless otherwise directed.
3. Correct any deviation from line and grade at no additional cost to the Owner.
4. Protect workers at all times from cave-in and other hazardous conditions.

D. Joints: Inspect each joint immediately after being completed and, if defective, shall be corrected before any more pipe is laid.

E. Concrete encasement
1. Place concrete encasements in locations and to the form and dimensions indicated.
2. Concrete for encasements shall be Class SE with that below the pipe dry mixed.
3. Take particular care to place the concrete under the pipe, and lay pipe in fresh concrete so that a complete support of the pipe will be made. Encasement at the sides and top may be placed after the concrete under this pipe has been set.

F. Manholes
1. Construct manholes as indicated on the Drawings and Specifications.
2. Take special care in forming the channels in the concrete bottom and use wooden templates or half sewer pipe for this work.
3. Plaster masonry work and castings as indicated on the Drawings.
4. In precast concrete manholes, the bottom section shall have cast openings of sufficient size to receive the sewer pipe. If such openings are not provided, the bottom portion may be constructed of masonry work from the concrete base to at least 6" above the top of the largest pipe entering the manhole and Precast sections placed from the masonry to the desired top elevation.
5. All the annular space between the sewer pipe and the opening in the manhole section shall be filled with brick and/or masonry to provide a waterproof seal.
6. Place the manhole casting on a minimum of 3 courses of masonry brick and a maximum of 5 courses of manhole brick. Install bricks radially. Precast concrete adjusting rings may be used in place of brick.
7. Mortar joints have to be smooth tooled joints.

G. Catch basins and inlets
1. Construct catch basins and inlets as indicated on the Drawings and Specifications.
2. Place catch basin and inlet castings on a minimum of 3 courses of manhole brick and a maximum of 5 courses of manhole brick. Install brick radially. Precast concrete adjusting rings may be used in place of brick.

H. Trench bracing: Install trench bracing in accordance with safety and other pertinent rules and regulations, and Division 31 Section “Earth Moving.”

I. Erosion control and sedimentation: Contractor to provide erosion control to minimize introduction of sedimentation into the system.

3.04 CLEANING

A. Prior to acceptance of storm sewers, underdrains, manholes and drainage structures, thoroughly clean those structures and remove all dirt and debris of whatever nature from inside sewer pipes, manholes and the like, and leave the site in a neat and clean condition.

END OF SECTION

SECTION 334605
SUBDRAINAGE SYSTEMS – PEASTONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 SCOPE

A. The work under this section consists of furnishing all labor, materials and equipment to install the drainage system, couplings and accessories for an operating sub-drainage system.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe
   b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fitting Materials
   c. ASTM F405 – Standard Specification for Corrugated Polyethylene Pipe and Fittings
2. American Association of State Highway and Transportation Officials (AASHTO):
   a. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe

1.4 SUBMITTALS

A. Manufacturer's Literature: Furnish to Landscape Architect, copies of manufacturer's specifications, maintenance, and installation instructions for each item specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 DRAINAGE TILE

A. Perforated corrugated polyethylene tubing (with filter wrap) complete with required couplings and fittings.

2.2 PEASTONE

A. 3/8" minus peastone to be used as backfill material.

PART 3 - EXECUTION

3.1 EXECUTION FOR CORRUGATED POLYETHYLENE TUBING

A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.

B. Place a two inch (2") thick bed of filter aggregate.

C. Install the drainage tile on the filter aggregate bed.

D. Ensure complete connection to storm sewer using perforated pipe.

E. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

END OF SECTION 334605

PLEASE RECYCLE

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

BID AND CONSTRUCTION

JANUARY 26, 2024

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

Willow School
Lansing School District
1012 W. Willow
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EL1.1B	LIGHTING PLAN - UNIT 100B
EL1.2	LIGHTING PLAN - UNIT 200
EL1.3	LIGHTING PLAN - UNIT 300
EL1.4	LIGHTING PLAN - UNIT 400
E4.0	ENLARGED ELECTRICAL PLANS
E5.0	ELECTRICAL DETAILS
E5.1	ELECTRICAL DETAILS
E6.0	PANEL SCHEDULES - 480/277V PANELS
E6.1	PANEL SCHEDULES - 208/120V PANELS
E6.2	PANEL SCHEDULES - 208/120V PANELS
E7.0	ELECTRICAL ONE-LINE/RISER DIAGRAM
E7.1	PHOTOVOLTAIC RISER DIAGRAM
TECHNOLOGY	
T0	COVER SHEET
T1	SITE PLAN
T2	COMPOSITE ALL UNITS FIBER INFRASTRUCTURE
T3.1A	COMPOSITE UNIT 100 STRUCTURED CABLING
T3.1B	COMPOSITE UNIT 200 STRUCTURED CABLING
T3.1C	COMPOSITE UNIT 300 STRUCTURED CABLING
T3.1D	COMPOSITE UNIT 400 STRUCTURED CABLING
T4.1A	COMPOSITE UNIT 100 CLOCK SYSTEM PUBLIC ADDRESS SYSTEM
T4.1B	COMPOSITE UNIT 200 CLOCK SYSTEM PUBLIC ADDRESS SYSTEM
T4.1C	COMPOSITE UNIT 300 CLOCK SYSTEM PUBLIC ADDRESS SYSTEM
T4.1D	COMPOSITE UNIT 400 CLOCK SYSTEM PUBLIC ADDRESS SYSTEM
T5.1A	COMPOSITE UNIT 100 AUDIOVISUAL SYSTEMS
T5.1B	COMPOSITE UNIT 200 AUDIOVISUAL SYSTEMS
T5.1C	COMPOSITE UNIT 300 AUDIOVISUAL SYSTEMS
T5.1D	COMPOSITE UNIT 400 AUDIOVISUAL SYSTEMS
T6.1A	COMPOSITE UNIT 100 ACCESS CONTROL SYSTEM
T6.1B	COMPOSITE UNIT 200 ACCESS CONTROL SYSTEM
T6.1C	COMPOSITE UNIT 300 ACCESS CONTROL SYSTEM
T6.1D	COMPOSITE UNIT 400 ACCESS CONTROL SYSTEM
T7	SITE PLAN VIDEO SURVEILLANCE SYSTEM
T7.1A	COMPOSITE UNIT 100 VIDEO SURVEILLANCE SYSTEM
T7.1B	COMPOSITE UNIT 200 VIDEO SURVEILLANCE SYSTEM
T7.1C	COMPOSITE UNIT 300 VIDEO SURVEILLANCE SYSTEM
T7.1D	COMPOSITE UNIT 400 VIDEO SURVEILLANCE SYSTEM
T9.1	DETAILS
T9.2	DETAILS
T9.3	DETAILS

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024
PR-01	04/19/2024

LSD **SB-005**
JOB 2616.01A

SHEET TITLE
TITLE SHEET

SHEET NO.
G0.1

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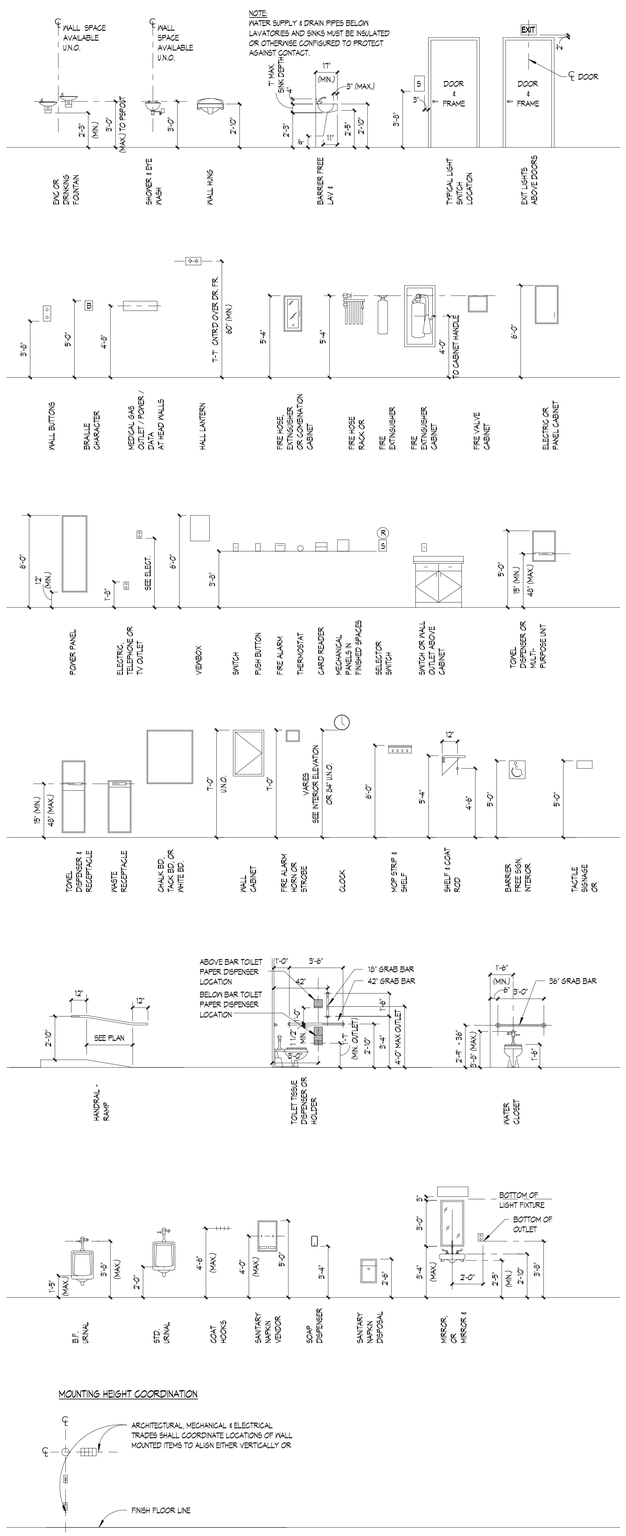
MOUNTING HEIGHTS (U.N.O.)

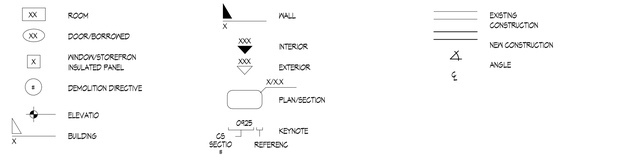


MOUNTING HEIGHT COORDINATION

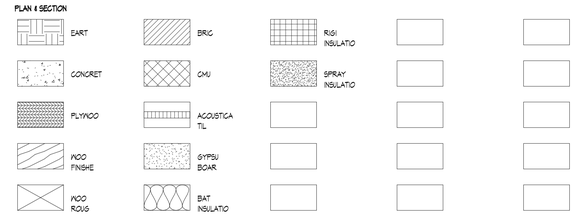
ABBREVIATIONS

ADJ	ADJACENT
AFF	ABOVE FINISHED FLOOR
AL / ALUM	ALUMINUM
ALT	ALTERNATE
APC	ACOUSTICAL PANEL CEILING
APPROX	APPROXIMATE
ARCH	ARCHITECT / ARCHITECTURAL
AVG	AVERAGE
AWP	ACOUSTICAL WALL PANEL
BD	BOARD
BF	BARRIER FREE
BFF	BELOW FINISHED FLOOR
BFST	BARRIER FREE STONE THRESHOLD
BL	BORROWED LIGHT
BLDG	BUILDING
BLK	BLOCK
BM	BEAM
BN	BULLNOSE
B.O.	BY OWNER
BOD	BOTTOM OF DECK
BOX	BOTTOM OF STEEL
BOT	BOTTOM
BP	BEARING PLATE
BRG	BEARING
BSMT	BASEMENT
CAB	CABINET
CAP	CAPACITY
CB	CHALKBOARD
CJ	CONTROL JOINT
CL	CENTER LINE
CLG	CEILING
CLO	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CNTR	COUNTER
COL	COLUMN
CONC	CONCRETE
CONST	CONSTRUCT OR CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
COR	CORRUGATED
CORR	CORRIDOR
CP	CENTER POINT
CPT	CARPET
CR / CLRM	CLASSROOM
CS	COUNTER SINK
CTF	CERAMIC TILE FLOOR
CTR	CENTER
CTW	CERAMIC TILE WALL
CUST	CUSTODIAN
CU YD	CUBIC YARDS
CYL	CYLINDER
DBL	DOUBLE
DEPT	DEPARTMENT
DET	DETAIL
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIR	DIRECTORY
DN	DOWN
DR	DOOR
DS	DOWNSPOUT
DWG	DRAWING
E	EAST
EA	EACH
EJ	EXPANSION JOINT
EL	ELEVATION
ELEV	ELEVATOR
EMER	EMERGENCY
ENCL	ELCLOSURE
ENT	ENTRANCE
EQ	EQUAL
EQUIP	EQUIPMENT
EST	ESTIMATE
EW	EACH WAY
EX / EXIST	EXISTING
EXP	EXPOSED
EXPN	EXPANSION
EXT	EXTERIOR
F	FAHRENHEIT
FB	FACEBRICK
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FH	FULL HEIGHT
FHC	FIRE HOSE CABINET
FIG	FIGURE
FIN	FINISH
FIX	FIXTURE
FL / FLR	FLOOR
FLEX	FLEXIBLE
FR	FRAME
FRPF	FIREPROOF
F.S.	FULL SIZE
FT	FEET
FTG	FOOTING
FURN	FURNITURE
FRP	FIBERGLASS REINFORCED PANEL
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR
GC	GENERAL CONTRACTOR
GEN	GENERAL
GL	GLASS
GOVT	GOVERNMENT
GYP	GYPSUM
HD	HAND
HDWR	HARDWARE
HDWD	HARDWOOD
HM	HOLLOW METAL
HORZ	HORIZONTAL
HP	HIGH POINT
HPC	HIGH PERFORMANCE COATING SYSTEM
HR	HOUR
HT	HEIGHT
ID	INSIDE DIAMETER
IN	INCH
INCL	INCLUDE
INFO	INFORMATION
INSUL	INSULATION
INT	INTERIORS
JAN	JANITOR
JC	JANITOR CLOSET
JCT	JUNCTION
JT	JOINT
KIT	KITCHEN
KP	KICK PLATE
KS	KNEEE SPACE
L	LENGTH
LAB	LABORATORY
LB	POUND
LIN	LINEAR
LKR	LOCKER
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LONG	LONGITUDINAL
LP	LOW POINT
LVT	LUXURY VINYL TILE
MAT / MATL	MATERIAL
MAX	MAXIMUM
MB	MARKERBOARD
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MS	METAL SHELVING
MTD	MOUNTED
MTL	METAL
MT	METAL TRANSITION
MWL	METAL WARDROBE LOCKER
N	NORTH
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
OFD	OVERFLOW DRAIN
OFF	OFFICE
OH	OVERHAED
OP	OPERABLE PARTITION
OPNG	OPENING
OPP	OPPOSITE
P / PT	PAINT
PART	PARTITION
PC	POLISHED CONCRETE
PERF	PERFORATED
PL	PLATE
PLAM	PLASTIC LAMINATE
PLAT	PLATFORM
PLWD	PLYWOOD
POL	POLISH
P.P.M.	PARTS PER MILLION
PR	PAIR
PREFAB	PREFABRICATED
PREFIN	PREFINISHED
PROJ	PROJECT
PSE	PROJECTION SCREEN - ELECTRIC
PSM	PROJECTION SCREEN - MANUAL
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT
PVC	POLYVINYL-CHLORIDE
1/4 RD	QUARTER ROUND
R / RAD	RADIUS
RAF	RESILIENT ATHLETIC FLOOR
RB	RESILIENT BASE / RUBBER BASE
RD	ROOF DRAIN
REC	RECESSED
RECT	RECTANGLE / RECTANGULAR
REF	REFERENCE
REINF	REINFORCED / REINFORCEMENT
REM	REMOVEABLE
RESIL	RESILIENT
REQD	REQUIRED
REV	REVISION
RFG	ROOFING
RFS	RUBBER FLOOR SHEET
RFT	RUBBER FLOOR TILE
RGH	ROUGH
RM	ROOM
RO	ROUGH OPENING
RSTA	RESILIENT STAIR TREAD ACCESSORY
RT	RESILIENT TRANSITION
S	SOUTH
SAF	SAFETY
SC	SEALED CONCRETE
SCH	SCHEDULE
SECT	SECTION
SECY	SECRETARY
SEQ	SEQUENCE
SHT	SHEET
SIM	SIMILAR
SPEC	SPECIFICATIONS
SPF	SOUNDPROOF
SPM	SINGLE PLY MEMBRANE
SQ	SQUARE
SS	STAINLESS STEEL
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL
SUB	SUB FLOOR
SUSP	SUSPENDED
STM	SYMMETRICAL
ST / STOR	STORAGE
SV	SHEET VINYL FLOORING
T	TOILET
T&G	TONGUE & GROOVE
TA	TOILET ACCESSORY
TB	TACK BOARD
TC	TOP CHORD
TCX	TOP CHORD EXTENSION
TEL	TELEPHONE
TEMP	TEMPERATURE
THK	THICK
TOB	TOP OF BEAM
TOF	TOP OF FOOTING
TOJ	TOP OF JOIST
TOL	TOP OF LEDGE
TOM	TOP OF MASONRY
TOS	TOP OF STEEL
TOW	TOP OF WALL
TS	TUBE STEEL
TV	TELEVISION
TYP	TYPICAL
TZ	TERRAZZO
TZT	TERRAZZO TILE
UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
VBS	VOLLEYBALL STANDARD
VCT	VINYL COMPOSITION TILE
VDB	VISUAL DISPLAY BOARD
VERT	VERTICAL
VEST	VESTIBULE
VIF	VERIFY IN FIELD
VIN	VINYL
VOL	VOLUME
VRB	VENTER RUBBER BASE
W	WEST
W/	WITH
WAF	WID ATHLETIC FLOOR
WB	WOOD BASE
WC	WALL COVERING
WD	WOOD
W/O	WITHOUT
W.P.	WORKING POINT
WPF	WATERPROOF
WT	WEIGHT
YD	YARD

ARCHITECTURAL & INTERIOR SYMBOLS



MATERIAL SYMBOLS



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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
DATA SHEET

SHEET NO.
G0.2

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LANSING SCHOOL DISTRICT
WILLOW ELEMENTARY

1012 W. WILLOW STREET
LANSING, MICHIGAN 48915

DEVELOPMENT TEAM

CIVIL ENGINEER
SPALDING DeDECKER
905 SOUTH BOULEVARD EAST
ROCHESTER HILLS, MICHIGAN 48307
CONTACT: CRAIG GENGLER
EMAIL: CGENGLER@SDA-ENG.COM
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KALAMAZOO, MICHIGAN 49007
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OWNER
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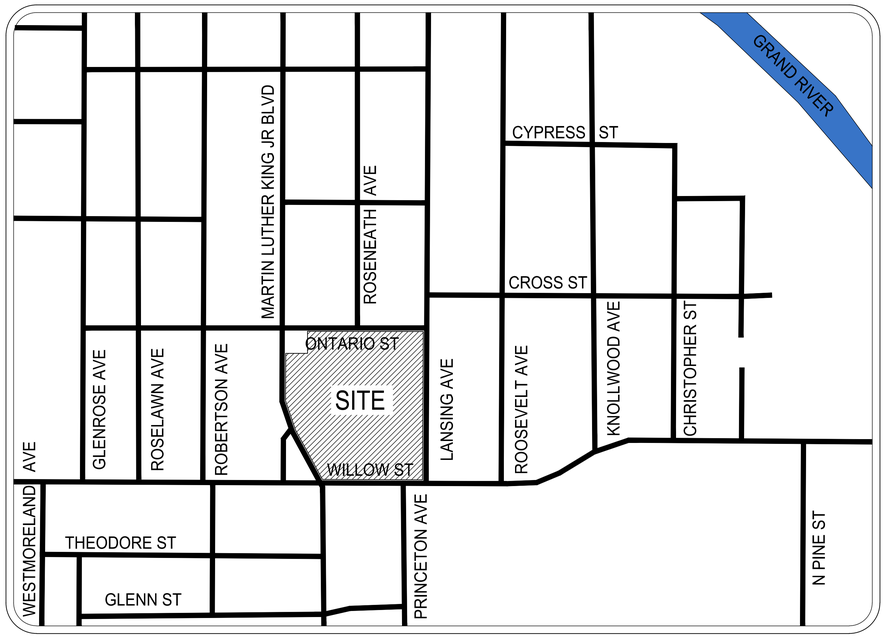
519 W. KALAMAZOO STREET
LANSING, MI 48933
517-755-1000

GOVERNING AGENCIES

PLANNING
CITY OF LANSING
DEPARTMENT OF ECONOMIC DEVELOPMENT & PLANNING
316 N. CAPITOL AVE.
LANSING, MI 48933
CONTACT SUSAN STACHOWIAK
PHONE 517-483-4085

ENGINEERING
CITY OF LANSING
PUBLIC SERVICE DEPARTMENT - ENGINEERING
124 W. MICHIGAN AVE.
LANSING, MI 48933
CONTACT DANIEL DANKE
PHONE 517-483-4461

FIRE DEPT.
CITY OF LANSING FIRE DEPARTMENT
120 E. SHIAWASSEE ST
LANSING, MI 48933
CONTACT MARK BURGER
PHONE 517-483-4200



LOCATION MAP
NTS

PROJECT NARRATIVE
THE NEW WILLOW ELEMENTARY SCHOOL WILL BE APPROXIMATELY 74,000 SQUARE FEET AND IS COMPRISED OF A MAIN BUILDING WITH THREE SEPARATE CLASSROOM POD BUILDINGS. SITE FEATURES INCLUDE PATHWAYS BETWEEN BUILDINGS, PLAYGROUND AREAS, COMMUNITY COURT, COMMUNITY GARDEN, AND ON GRADE PARKING WITH CIRCULATION TO AND FROM THE PROPERTY.

WETLANDS
THERE ARE NO EXISTING WETLANDS ON-SITE.

FLOODPLAIN NOTE
PER THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD MAP (MAP NO. 26125C0658F, DATED SEPTEMBER 29, 2006), THE SITE LIES WITHIN ZONE X WHICH ARE AREAS DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN.

CIVIL SHEET INDEX	
Sheet Number	Sheet Title
C1.0	GENERAL PLAN
C2.1	DEMOLITION PLAN
C3.1	SESC PLAN
C3.2	SESC DETAILS
C4.1	PAVING PLAN
C4.2	PAVING DETAILS
C5.1	GRADING PLAN
C5.2	GRADING PLAN
C6.1	UTILITY PLAN
C6.2	UTILITY DETAIL
C6.3	UTILITY DETAIL
C6.4	UTILITY DETAIL
C7.1	DRAINAGE AREA MAP

ATTACHED PLANS
- TOPOGRAPHIC/BOUNDARY SURVEY BY CAMPBELL SURVEYING ENGINEERING, INC. DATED NOV. 14, 2022 (1 SHEET)
- STRUCTURE INVERT REPORT BY CAMPBELL SURVEYING ENGINEERING, INC. DATED OCT. 15 2022 (3 SHEETS)

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024
PR - #1	04.18.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE
COVER

SHEET NO.
C0.0

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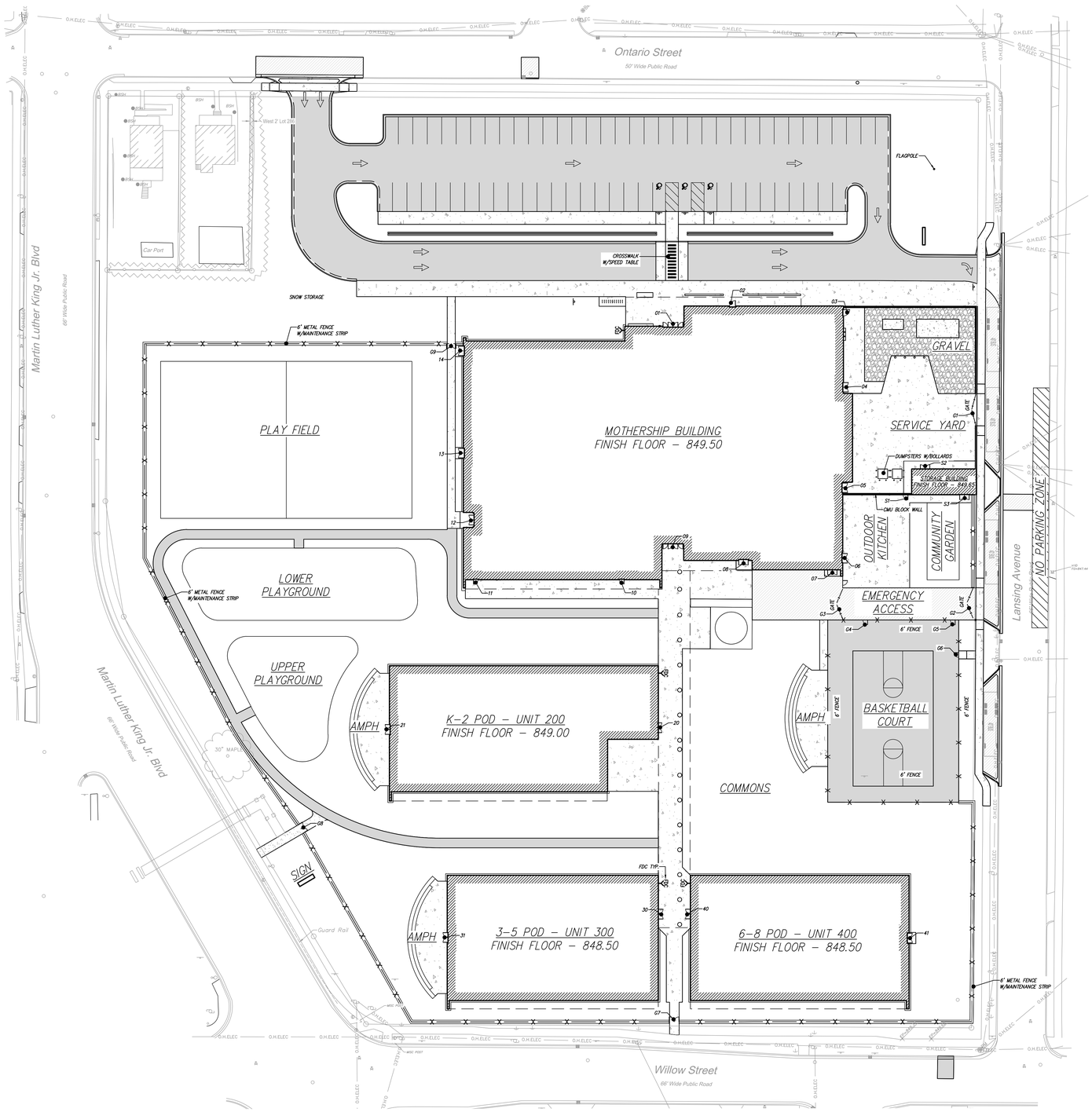

LEGEND

- PROPOSED WATERMAIN
- PROPOSED SANITARY
- PROPOSED STORM SEWER
- PROPOSED GAS MAIN
- PROPOSED ELECTRIC
- PROPOSED HYDRANT
- PROPOSED GATE VALVE & WELL (GVW)
- PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)
- PROPOSED SAN MANHOLE (SAN)
- PROPOSED STORM MANHOLE (MH)
- PROPOSED CATCH BASIN (CB)
- PROPOSED INLET (INL)
- PROPOSED END SECTION (ES)
- PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
- STANDARD BITUMINOUS PAVEMENT
- HEAVY–DUTY BITUMINOUS PAVEMENT
- DEEP–STRENGTH BITUMINOUS PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK
- MILL PAVEMENT
- (2) UTILITY CROSSING (SEE DATA TABLE)
- STORM SEWER STRUCTURE: CB STRUCT. TYPE; 2 STRUCT. NO.
- SANITARY SEWER STRUCTURE: (20)
- WATERMAIN STRUCTURE: 10 STRUCT. NO.; XXX STRUCT. TYPE

GRAPHIC SCALE
0 15 30 60
(IN FEET)
1 inch = 30 ft.

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
CRAIG A. GENGLER
ENGINEER
DESIGN PROFESSIONAL ENGINEER

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

GENERAL PLAN

SHEET NO.

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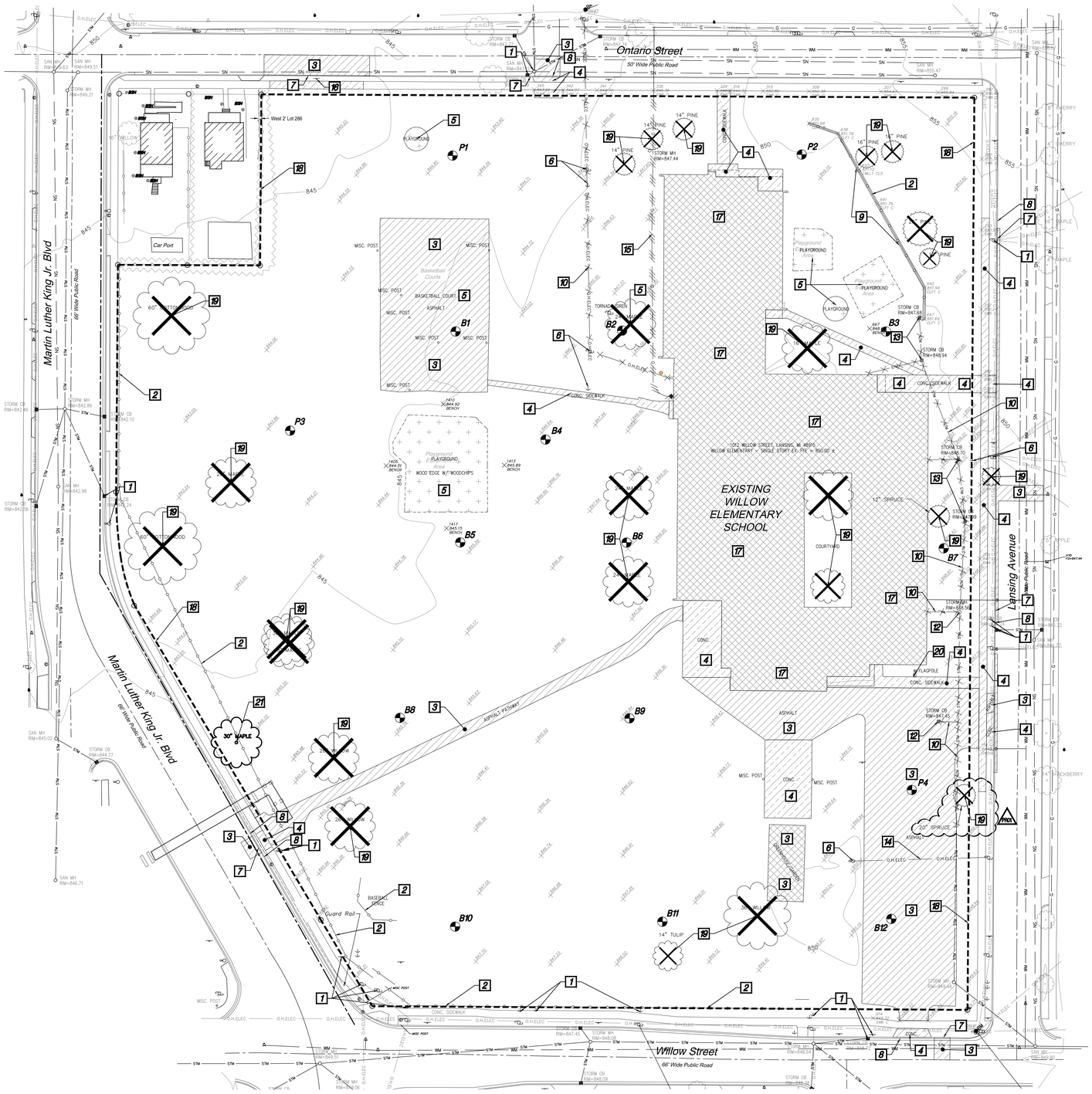


DEMOLITION NOTES

1. PROTECT EXISTING UTILITIES AND UTILITY STRUCTURES TO REMAIN.
2. REMOVE EXISTING CHAIN LINK FENCE, INCLUDING ALL GATES, POSTS, AND FOOTINGS.
3. REMOVE ASPHALT PAVEMENT TO FULL DEPTH (ASSUMED TO BE 2"-4" BASED ON THE GEOTECH REPORTS). SAWCUT FULL DEPTH WHERE NEW PAVEMENT WILL BE PLACED ADJACENT TO EXISTING PAVEMENT. EXCAVATE EXISTING AGGREGATE BASE AND SUBGRADE AS NECESSARY TO INSTALL NEW PAVEMENT SECTION INCLUDING NEW AGGREGATE BASE
4. REMOVE CONCRETE PAVEMENT TO FULL DEPTH. SAWCUT FULL DEPTH TO NEAREST JOINT WHERE NEW PAVEMENT WILL BE PLACED ADJACENT TO EXISTING PAVEMENT.
5. REMOVE AND DISPOSE OF RECREATIONAL, ATHLETIC, AND PLAYGROUND EQUIPMENT, BENCHES, BLEACHERS, ETC. THAT FALL WITHIN THE CONSTRUCTION AREA.
6. REMOVE EXISTING UTILITIES AND UTILITY STRUCTURES.
7. REMOVE CONCRETE CURB AND GUTTER, SAWCUT FULL DEPTH TO NEAREST JOINT, WHERE SHOWN. REMOVAL LIMITS TO BE FIELD VERIFIED BY ENGINEER.
8. PROTECT EXISTING CONCRETE CURB AND GUTTER TO REMAIN.
9. REMOVE EXISTING RETAINING WALL, INCLUDING FOOTINGS.
10. REMOVE EXISTING UTILITY PIPE, BACKFILL WITH CLASS II FILL AND COMPACT TO 95% OF MAXIMUM DENSITY.
11. ABANDON EXISTING UTILITY PIPE IN PLACE (CONTRACTOR TO CONFIRM NO CONFLICTS). CUT AND INSTALL WATERTIGHT CAP AT EXISTING PIPE AND INSTALL BULKHEAD AT STRUCTURES WHERE PIPE IS TO BE ABANDONED IN PLACE. FILL WITH FLOWABLE GROUT.
12. REMOVE EXISTING UTILITY STRUCTURE COMPLETE. BACKFILL WITH CLASS II FILL AND COMPACT TO 95% MAXIMUM DENSITY.
13. ABANDON EXISTING UTILITY STRUCTURE. REFER TO DETAIL.
14. REMOVE AND DISPOSE OF EXISTING OVERHEAD ELECTRICAL LINES. CONTRACTOR TO COORDINATE REMOVAL OF OVERHEAD ELECTRICS WITH BWL. CONTRACTOR TO KEEP ANY EXISTING BUILDING OVERHEAD ELECTRICAL LINES ACTIVE UNTIL BUILDING DEMOLITION PROCESS BEGINS.
15. ABANDON EXISTING GAS MAIN, INCLUDING, BUT NOT LIMITED TO ALL VALVES, REGULATORS, AND METERS AS SHOWN. CAP EXISTING GAS SERVICE TO THE MAIN LINE. REMOVE AND CAP EXISTING GAS MAIN AS NECESSARY. CONTRACTOR TO KEEP ANY EXISTING BUILDING GAS LINES ACTIVE UNTIL THE BUILDING DEMOLITION PROCESS BEGINS.
16. REMOVE AND SALVAGE EXISTING SIGN.
17. REMOVE AND PROPERLY DISPOSE OF THE ENTIRE EXISTING BUILDING INCLUDING (BUT NOT LIMITED TO) ROOF, STRUCTURE, WALLS, DOORS, WINDOWS, FIXTURES, EQUIPMENT, MEP SYSTEMS, FLOOR SLAB, FOUNDATION WALLS, AND FOOTINGS. BACKFILL EXCAVATIONS FROM DEMOLITION ACTIVITIES WITH CLASS 2 ENGINEERED FILL AND COMPACT TO 95% OF MAXIMUM DENSITY. CUT AND CAP ALL IMPACTED SITE UTILITIES AS INDICATED
18. CLEAR AND GRUB TO THE LIMITS SHOWN. INCLUDE REMOVAL OF ALL SIGNS, POSTS, FOOTINGS, GRAVEL, BRUSH, SHRUBS, GRASS, AND TREES NOT INDICATED FOR PROTECTION, INCLUDING ROOTS. STRIP TOPSOIL AND STOCKPILE ON SITE IN DESIGNATED LOCATION.
19. REMOVE EXISTING TREE (INCLUDING STUMPS AND ROOTS).
20. REMOVE AND DISPOSE OF EXISTING FLAG POLE, INCLUDING ANY FOOTINGS.
21. PROTECT EXISTING TREE. SEE TREE PROTECTION FENCE DETAIL THIS SHEET

UNLESS OTHERWISE SPECIFIED, PROTECT EXISTING UTILITIES AND UTILITY STRUCTURES TO REMAIN.

EXISTING SIGNAGE AND MAILBOXES WITHIN THE CLEARING LIMITS ARE TO BE REMOVED AND DISPOSED OF.

REMOVE EXISTING LIGHT POLES. REMOVE AND PROPERLY DISPOSE OF ELECTRICAL DEVICES AND ALL CONNECTIONS.

ABANDON EXISTING STORM SEWER PIPE IN PLACE (CONTRACTOR TO CONFIRM NO CONFLICTS). CUT AND INSTALL WATERTIGHT CAP AT EXISTING PIPE AND INSTALL WATERTIGHT BULKHEAD AT STRUCTURES WHERE PIPE IS TO BE ABANDONED IN PLACE. REMOVE AND INSTALL WATERTIGHT CAPS FOR EXISTING STORM SEWER PIPE AS NECESSARY. FILL WITH FLOWABLE GROUT. CONTRACTOR TO KEEP ANY EXISTING BUILDING STORM LINES ACTIVE UNTIL THE BUILDING DEMOLITION PROCESS BEGINS.

CUT EXISTING SANITARY SEWER STRUCTURE 3' BELOW GRADE. FILL WITH GROUT AND BACKFILL UP TO GRADE WITH CLASS II FILL AND COMPACT TO 95% OF MAXIMUM DENSITY. REFER TO EXISTING UTILITY STRUCTURE ABANDONMENT DETAIL THIS SHEET FOR ABANDONMENT PROCESS. CONTRACTOR TO KEEP ANY EXISTING BUILDING SANITARY LINES ACTIVE UNTIL THE BUILDING DEMOLITION PROCESS BEGINS.

ABANDON EXISTING SANITARY SEWER PIPE IN PLACE (CONTRACTOR TO CONFIRM NO CONFLICTS). CUT AND INSTALL WATERTIGHT CAP AT EXISTING PIPE AND INSTALL WATERTIGHT BULKHEAD AT STRUCTURES WHERE PIPE IS TO BE ABANDONED IN PLACE. REMOVE AND INSTALL WATERTIGHT CAPS FOR EXISTING SANITARY SEWER PIPE AS NECESSARY. FILL WITH FLOWABLE GROUT. CONTRACTOR TO KEEP ANY EXISTING BUILDING SANITARY LINES ACTIVE UNTIL THE BUILDING DEMOLITION PROCESS BEGINS.

ABANDON EXISTING WATER MAIN PIPE AND APPLICABLE STRUCTURES (CONTRACTOR TO CONFIRM NO CONFLICTS). BACKFILL WITH CLASS II SAND AND COMPACT TO 95% MAXIMUM DENSITY. INSTALL WATERTIGHT PLUGS AND THRUST BLOCKS WHERE EXISTING WATER MAIN PIPE ARE TO BE DISCONNECTED. CONTRACTOR TO KEEP ANY EXISTING BUILDING WATER MAIN LINES ACTIVE UNTIL THE BUILDING DEMOLITION PROCESS BEGINS.

ALL DEPRESSIONS CREATED BY DEMOLITION PROCEDURES SHALL BE BACKFILLED WITH CLASS II FILL MATERIAL, IN 8" LIFTS COMPACTED TO 95% OF MAXIMUM UNIT WEIGHT, UP TO PROPOSED SUBGRADE.

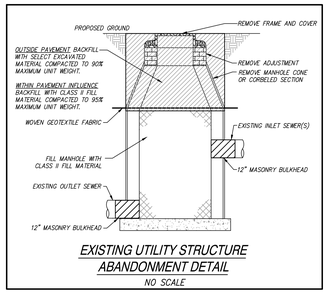
CONTRACTOR IS RESPONSIBLE FOR DOING AN EARTHWORK CALCULATION FOR CUT AND FILL REQUIREMENTS, AND IS RESPONSIBLE FOR INCLUDING IMPORT AND EXPORT OF MATERIALS IN THEIR BID. ALL EXCESS MATERIAL (INCLUDING TOPSOIL, CLEAN FILL, AND WASTE MATERIAL) SHALL BE REMOVED FROM THE SITE.

CONTRACTOR TO PROTECT EXISTING WALKS, PAVEMENT, CURBS, GUTTERS, WALLS, FENCES, GATES, LANDSCAPING AND TREES TO REMAIN DURING CONSTRUCTION.

KINGSCOTT ASSOCIATES, INC. WILL PREPARE AND INCLUDE SPECIFICATION SECTION 012200 UNIT PRICES FOR UNDERCUT AND REPLACEMENT OF POOR SOILS. UNIT PRICE TO INCLUDE DISPOSAL OF POOR SOILS AND IMPORT AND PLACEMENT OF 1"X3" CRUSHED CONCRETE OR 21AA CRUSHED CONCRETE, WITH GEOTEXTILE FABRIC, UP TO PROPOSED SUBGRADE.

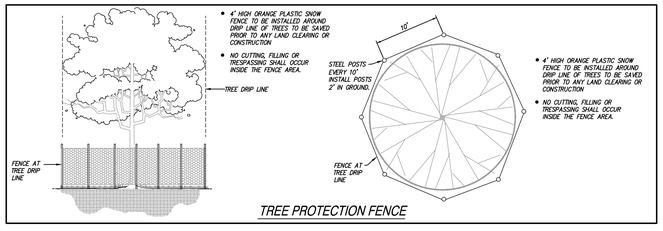
PROTECT GEOTHERMAL BORINGS DURING DEMOLITION

XX — APPROXIMATE BORING LOCATION WITH ID



EXISTING UTILITY STRUCTURE ABANDONMENT DETAIL

NO SCALE



TREE PROTECTION FENCE

GRAPHIC SCALE

0 15 30 60

(IN FEET)
1 inch = 30 ft.

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024
PR - #1	04.18.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

DEMOLITION PLAN

SHEET NO.

C2.1

Plotted: Apr 18, 2024, 1:51 PM by user: 1175 – Saved: 4/18/2024 by user: 1175
N:\WP\Wild Projects\WP23018 – Lansing Schools – Willow ES\DWG\WP-2023BLEM.dwg

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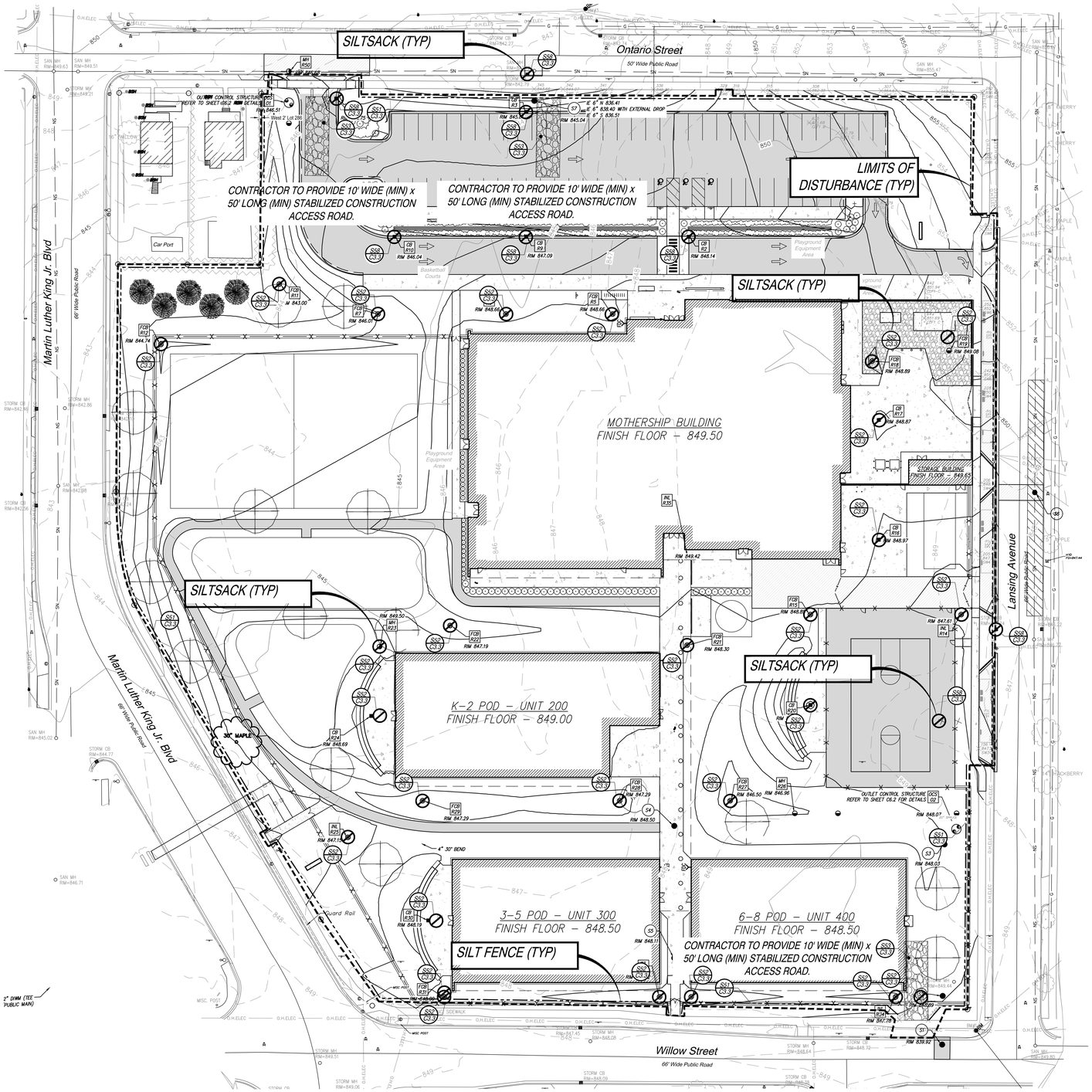

GRAPHIC SCALE

0 15 30 60

(IN FEET)
1 inch = 30 ft.

LEGAL DESCRIPTION

OWNER: LANSING SCHOOL DISTRICT
TAX PARCEL ID: 33-01-01-08-280-002
ADDRESS: 1012 W WILLOW STREET

COMMENCING AT THE NORTHEAST CORNER OF LOT 286, NORTH HIGHLAND SUBDIVISION, CITY OF LANSING, INGHAM COUNTY, MICHIGAN. THENCE NORTH 89 DEGREES 58 MINUTES EAST 408 FEET; THENCE SOUTH 577.5 FEET; THENCE SOUTH 89 DEGREES 58 MINUTES WEST 377 FEET; THENCE NORTHWESTERLY TO POINT ON THE EAST LINE OF LOT 301, 54.43 FEET NORTH OF THE SOUTHEAST CORNER; THENCE NORTH 523.07 FEET TO THE BEGINNING. ALSO LOT 286, EXCEPT THE WEST 2 FEET AND LOTS 289, 290, 291 AND 292. ALSO THAT PART OF LOTS 293 THROUGH 298 AND 301 LYING EASTERLY OF THE EAST RIGHT OF WAY LINE OF NORTH LOGAN STREET

SOIL EROSION CONTROL DEVICES

(SEE SHEET C6.2 FOR SESC DETAILS)

- INLET FILTERS
- 24" SILT FENCE

LEGEND

- PROPOSED WATERMAIN
- PROPOSED SANITARY
- PROPOSED STORM SEWER
- PROPOSED GAS MAIN
- PROPOSED ELECTRIC
- PROPOSED HYDRANT
- PROPOSED GATE VALVE & WELL (GVW)
- PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)
- PROPOSED SAN MANHOLE (SAN)
- PROPOSED STORM MANHOLE (MH)
- PROPOSED CATCH BASIN (CB)
- PROPOSED INLET (INL)
- PROPOSED END SECTION (ES)
- PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
- UTILITY CROSSING (SEE DATA TABLE)
- STANDARD BITUMINOUS PAVEMENT
- HEAVY-DUTY BITUMINOUS PAVEMENT
- DEEP-STRENGTH BITUMINOUS PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK
- MILL PAVEMENT
- STORM SEWER STRUCTURE: CB 2 — STRUCT. TYPE / STRUCT. NO.
- SANITARY SEWER STRUCTURE: 20
- WATERMAIN STRUCTURE: 10 / XXX — STRUCT. NO. / STRUCT. TYPE

GRADING LEGEND

- 850.00 — EXISTING ELEVATION
- TC 000.00 — PROPOSED TOP OF CURB ELEVATION
- G 000.00 — PROPOSED GUTTER ELEVATION
- OG 000.00 — OUTSIDE GRADE ELEVATION
- 11.50 — EXISTING CONTOURS
- 11.50 — PROPOSED CONTOURS
- TP 000.00 — TOP OF PAVEMENT ELEVATION
- TW 000.00 — TOP OF WALK ELEVATION
- FG 000.00 — FINISH GRADE ELEVATION
- T/WALL 000.00 — TOP OF WALL ELEVATION
- ME 000.00 — MATCH EXISTING ELEVATION
- FLOW ARROW

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STATE OF MICHIGAN
CRAIG A. GENGLER
ENGINEER
PROFESSIONAL ENGINEER

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

SESC PLAN

SHEET NO.

C3.1

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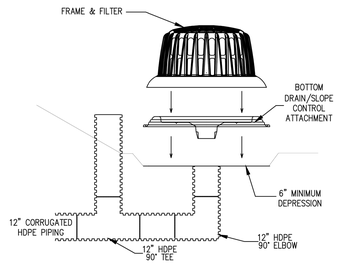
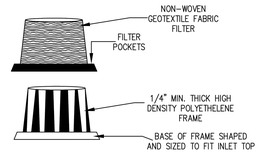
S52 CATCH BASIN SEDIMENT GUARD



INSTALLATION PROFILE



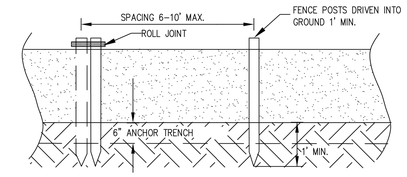
FILTER & FRAME PROFILE

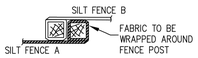
STANDARD SYMBOL

Adapted from: Silt-Saver, Inc.

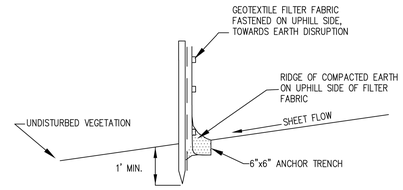
STATE OF MICHIGAN
DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET
STATE FACILITIES ADMINISTRATION

S51 SILT FENCE





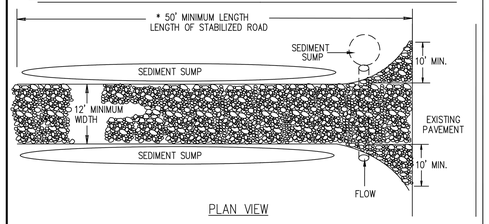
ROLL JOINTS



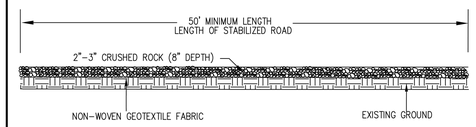
STANDARD SYMBOL

STATE OF MICHIGAN
DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET
STATE FACILITIES ADMINISTRATION

S53 STABILIZED CONSTRUCTION ACCESS



PLAN VIEW



PROFILE

NOTES:
1. Establish stabilized construction entrance prior to the initiation of site construction activities.
2. Care should be taken to prevent material movement into adjacent wetlands/waterbodies.
3. Care should be taken to maintain existing roadside drainage via culvert installation, with sediment sump placed downflow of culvert.

STANDARD SYMBOL

STATE OF MICHIGAN
DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET
STATE FACILITIES ADMINISTRATION

SOIL EROSION/SEDIMENTATION CONTROL NOTES

1. ALL EROSION AND SEDIMENT CONTROL WORK SHALL CONFORM TO THE STANDARDS AND SPECIFICATIONS OF CITY OF LANSING.
2. DAILY INSPECTIONS SHALL BE MADE BY THE CONTRACTOR TO DETERMINE EFFECTIVENESS OF EROSION AND SEDIMENTATION CONTROL DEVICES, AND ANY NECESSARY REPAIRS SHALL BE PERFORMED WITHOUT DELAY.
3. EROSION AND ANY SEDIMENT FROM WORK ON THIS SITE SHALL BE CONTAINED ON THE SITE AND NOT ALLOWED TO COLLECT ON ANY OFF-SITE AREAS OR IN WATER WAYS. WATERWAYS INCLUDE BOTH NATURAL AND MANMADE OPEN DITCHES, STREAMS, STORM DRAINS, LAKES AND PONDS.
4. EROSION AND SEDIMENT CONTROL DEVICES ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CONSTRUCTION. SEDIMENT CONTROL PRACTICES WILL BE APPLIED AS A PERIMETER DEFENSE AGAINST ANY TRANSPORTING OF SILT OFF THE SITE.
5. CONTRACTOR SHALL APPLY TEMPORARY EROSION AND SEDIMENTATION CONTROL DEVICES AS REQUIRED AND AS DIRECTED ON THESE PLANS. HE SHALL REMOVE TEMPORARY DEVICES AS SOON AS PERMANENT STABILIZATION OF SLOPES, DITCHES, AND OTHER EARTH CHANGES HAVE BEEN ACCOMPLISHED AND APPROVED BY THE CHARTER TOWNSHIP OF COMMERCE.
6. DEBRIS FROM PROJECT WILL BE LEFT ON THE SITE BY DELIVERY OR CONSTRUCTION VEHICLES THROUGH THE USE OF CLEAN STONE EXITS. SHOULD THE STONE BECOME LESS EFFECTIVE IT WILL BE REPLACED. ALL CONSTRUCTION TRAFFIC WILL USE THE CLEAN STONE EXIT.
7. DUST CONTROL WILL BE EXERCISED AT ALL TIMES WITHIN THE PROJECT BY THE CONTRACTORS. SPRINKLING TANK TRUCKS WILL BE AVAILABLE AT ALL TIMES TO BE USED ON HAUL ROUTES OR OTHER PLACES WHERE DUST BECOMES A PROBLEM.
8. IMMEDIATELY AFTER SEEDING, MULCH ALL SEEDED AREAS WITH UNWEATHERED SMALL GRAIN STRAW OR HAY. SPREAD UNIFORMLY AT A RATE OF 1 1/2 TO 2 TONS PER ACRE OR 0.10 POUNDS PER SQUARE FEET. ANCHOR MULCH WITH DISC TYPE MULCH ANCHORING TOOL.
9. ALL MUD, DIRT, AND DEBRIS TRACKED ONTO EXISTING ROADS FROM THIS SITE SHALL BE PROMPTLY REMOVED BY THE CONTRACTOR OR BUILDER. ALL MUD, DIRT, AND DEBRIS TRACKED OR SPILLED ONTO PAVED SURFACES WITHIN THIS SITE SHALL BE PROMPTLY REMOVED BY THE CONTRACTOR.
10. PERMANENT SOIL EROSION CONTROL DEVICES FOR ALL SLOPES, CHANNELS, DITCHES OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN 15 CALENDAR DAYS AFTER FINAL GRADING OR FINAL EARTH CHANGES HAVE BEEN COMPLETED. WHEN IT IS NOT POSSIBLE TO PERMANENTLY STABILIZE A DISTURBED AREA AFTER AN EARTH CHANGE HAS BEEN COMPLETED OR WHERE SIGNIFICANT EARTH CHANGE ACTIVITY CEASES TEMPORARY SOIL EROSION CONTROL DEVICES SHALL BE IMPLEMENTED WITHIN 30 CALENDAR DAYS. ALL TEMPORARY SOIL EROSION CONTROL DEVICES SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION DEVICES ARE IMPLEMENTED AND/OR ESTABLISHED. ALL PERMANENT SOIL EROSION CONTROL DEVICES WILL BE IMPLEMENTED AND ESTABLISHED BEFORE A CERTIFICATE OF INSURANCE IS ISSUED.
11. ALL CONTRACTORS ARE TO KEEP EXCAVATED MATERIAL ON SITE. PARTICULAR CARE SHOULD BE TAKEN WHEN WORKING ALONG THE PERIMETER OF THE SITE. IN NO EVENT SHALL THE WORK AREA EXTEND BEYOND THE LIMITS INDICATED ON THE PLANS.
12. THE SOIL EROSION CONTROLS WILL BE MAINTAINED WEEKLY AND AFTER EVERY STORM EVENT BY THE CONTRACTOR.

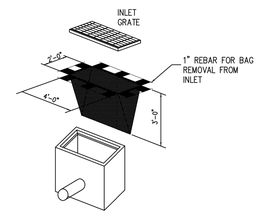
SITE NOTES:

APPROX. GROSS ACREAGE DISTURBED =6.46± ACRES
DISTANCE TO NEAREST BODY OF WATER (GRAND RIVER) = 1,789 FEET

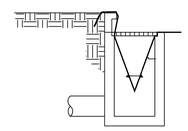
SOIL TYPES:
UrB: Urban land-Marlette complex, 2 to 12 percent slopes

THIS PROJECT SHALL BE CONSTRUCTED IN COMPLIANCE WITH PART 91 OF ACT 451 OF 1994, AS AMENDED. THE SOIL EROSION AND SEDIMENT CONTROL ACT.

S58 INLET PROTECTION – FABRIC DROP



ISOMETRIC VIEW

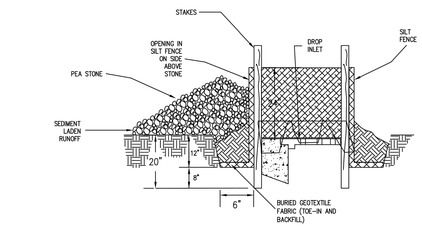


INSTALLATION DETAIL

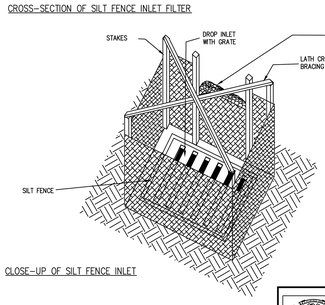
STANDARD SYMBOL

STATE OF MICHIGAN
DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET
STATE FACILITIES ADMINISTRATION

S59 INLET PROTECTION – FABRIC FENCE



CROSS-SECTION OF SILT FENCE INLET FILTER



CLOSE-UP OF SILT FENCE INLET

STANDARD SYMBOL

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STATE OF MICHIGAN
CRAIG A. GENGLER
ENGINEER
PROFESSIONAL ENGINEER

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

SESC DETAILS

SHEET NO.

C3.2

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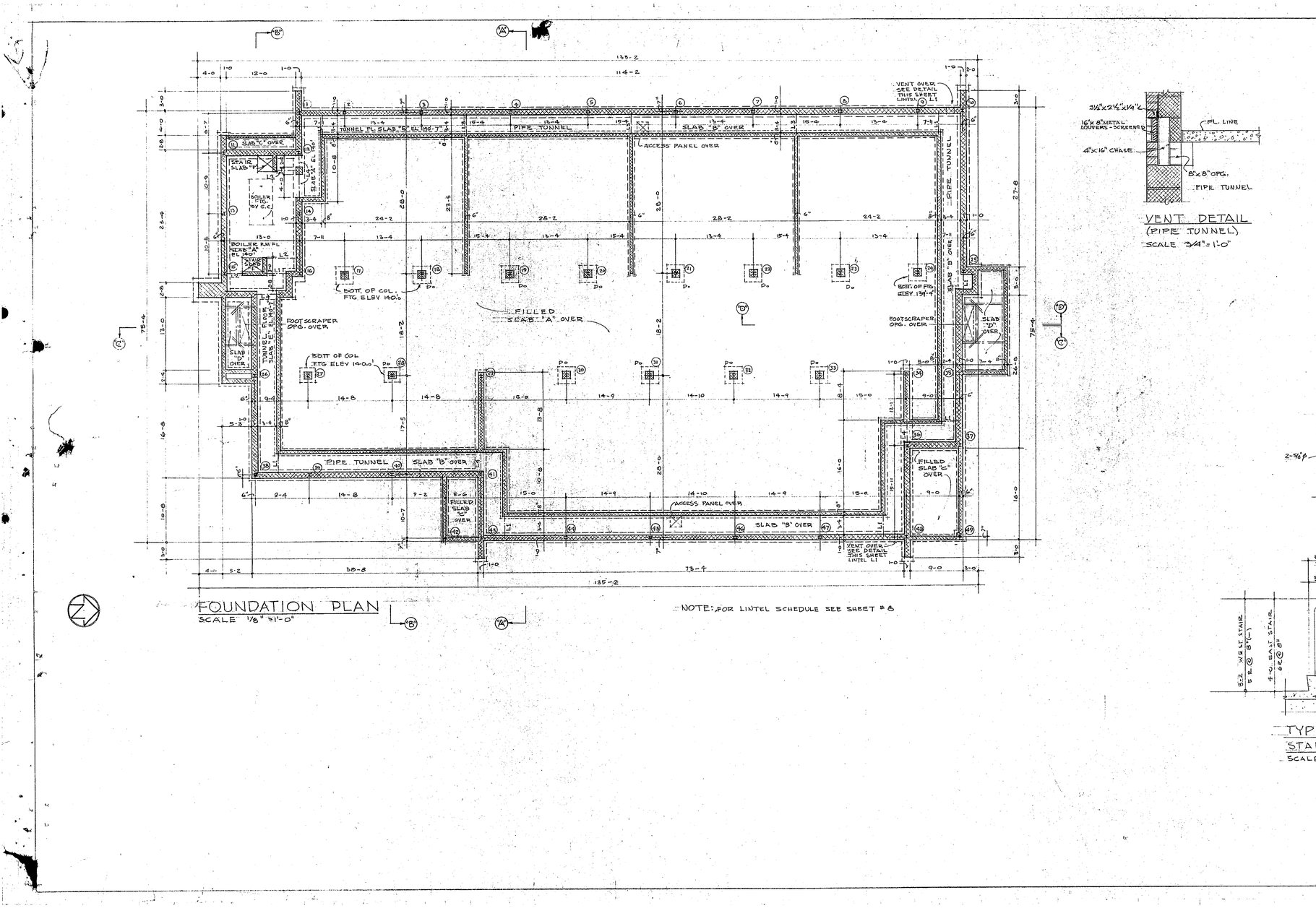


FOUNDATION PLAN
SCALE 1/8" = 1'-0"

NOTE: FOR LINTEL SCHEDULE SEE SHEET #8

VENT DETAIL
(PIPE TUNNEL)
SCALE 3/4" = 1'-0"

CONC. SLAB SCHEDULE

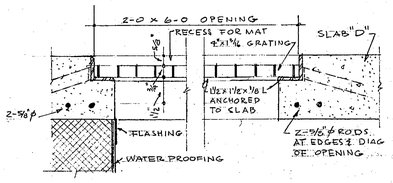
MARK	THICKNESS	REINFORCEMENT	REMARKS
A	4"	6x6 #10 MESH	ON SAND FILL
B	4"	6x6 #10 MESH DOUBLED	SLABS OVER PIPE TUNNEL
C	4"	3/8" ϕ RODS 8" o.c E.W.	ON SAND FILL
D	4"	3/8" ϕ RODS 8" o.c E.W.	2-5/8" ϕ AT EDGES & DIAG. AT FOOTSCRAPER OPNGS.
E	3"	NONE	PIPE TUNNEL FLOOR SLAB ON FILL
F	3"	3/8" ϕ RODS 7" o.c	

FOOTING SCHEDULE

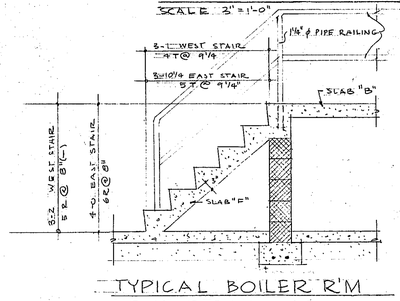
FOUNDATION WALL	SIZE OF FOOTINGS	REINFORCEMENT	REMARKS
12"	2'-0" x 1'-0"	3 - 5/8" ϕ RODS CONT.	
8"	1'-4" x 8"	2 - 5/8" ϕ RODS CONT.	
6"	1'-0" x 8"	2 - 5/8" ϕ RODS CONT.	

COLUMN FTGS FOR COL. # 17-24; 27; 28 & 30-33 TO BE 2'-0" x 2'-8" x 1'-0". BOTTOM ELEVATION OF FTG. 140'-0"
EXEPT COL # 24 BOTTOM ELEVATION OF FTG. 139'-4"
PIERS TO BE 16" x 16" CONC. BLOCK (CELLS FILLED WITH CONC).
NO REINFORCING FOR FTGS.

BOILER FTG. APPROX. 4'-0" x 8'-0" x 8" NO REINFORCING



FOOTSCRAPER DETAIL
SCALE 3" = 1'-0"



TYPICAL BOILER R'M
STAIR DETAIL
SCALE 1/2" = 1'-0"

AN ELEMENTARY SCHOO
FOR WILLOW STREET SITE
LANSING MI

Manson & Garner
REGISTERED ARCHITECTS
410 WEST BAGHAW, LANSING

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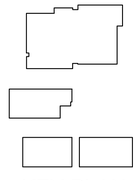
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
PROGRESS SET	07.26.2023
DEMOLITION SET	07.28.2023



KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE
ORIGINAL TUNNEL PLANS

SHEET NO.
C 4.0

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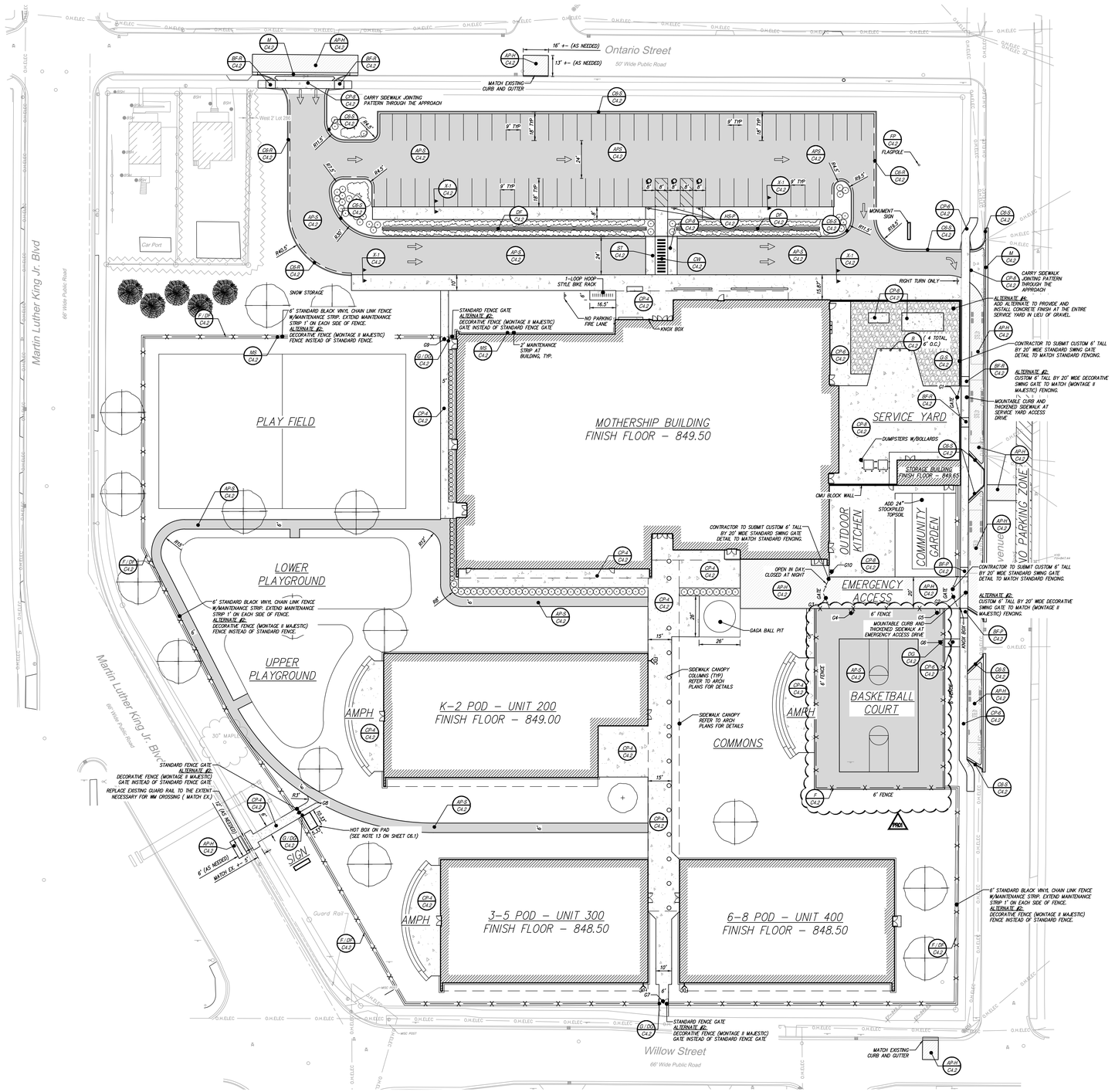

GRAPHIC SCALE

0 15 30 60

(IN FEET)
1 inch = 30 ft.

GRADING LEGEND

850	EXISTING ELEVATION
• TC 000.00 G 000.00	PROPOSED TOP OF CURB ELEVATION PROPOSED GUTTER ELEVATION
• OG 000.00	OUTSIDE GRADE ELEVATION
11.30 11.31	EXISTING CONTOURS
11.30	PROPOSED CONTOURS
• TP 000.00	TOP OF PAVEMENT ELEVATION
• TW 000.00	TOP OF WALK ELEVATION
• FG 000.00	FINISH GRADE ELEVATION
• T/WALL 000.00	TOP OF WALL ELEVATION
• ME 000.00	MATCH EXISTING ELEVATION
	FLOW ARROW

LEGEND

- PROPOSED WATERMAIN
- PROPOSED SANITARY
- PROPOSED STORM SEWER
- PROPOSED GAS MAIN
- PROPOSED ELECTRIC
- PROPOSED HYDRANT
- PROPOSED GATE VALVE & WELL (GVW)
- PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)
- PROPOSED SAN MANHOLE (SAN)
- PROPOSED STORM MANHOLE (MH)
- PROPOSED CATCH BASIN (CB)
- PROPOSED INLET (INL)
- PROPOSED END SECTION (ES)
- PROPOSED FIELD CATCH BASIN (TCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
- STANDARD BITUMINOUS PAVEMENT
- HEAVY-DUTY BITUMINOUS PAVEMENT
- DEEP-STRENGTH BITUMINOUS PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK
- MILL PAVEMENT
- 2 — UTILITY CROSSING (SEE DATA TABLE)
- STORM SEWER STRUCTURE: CB — STRUCT. TYPE; 2 — STRUCT. NO.
- SANITARY SEWER STRUCTURE: 20
- WATERMAIN STRUCTURE: 10 — STRUCT. NO.; XXX — STRUCT. TYPE
- DECORATIVE GATE: GXX

PAVING CONSTRUCTION NOTES

1. EARTHWORK AND PAVEMENT CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION UNLESS OTHERWISE NOTED IN THE FOLLOWING ITEMS.
2. REMOVE ANY EXISTING TOPSOIL, VEGETATION, TREES AND OTHER DELETERIOUS MATERIALS TO EXPOSE THE SUBGRADE SOIL. TREE ROOTS SHALL BE COMPLETELY REMOVED.
3. EXCAVATE TO THE DEPTH OF THE FINAL SUBGRADE ELEVATION TO ALLOW FOR GRADE CHANGES AND THE PLACEMENT OF THE RECOMMENDED PAVEMENT SYSTEM.
4. THE TOP 12 INCHES OF THE EXPOSED SUBGRADE SHALL BE COMPACTED TO A DENSITY NO LESS THAN 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE MODIFIED PROCTOR (ASTM D 1557-91).
5. THE FINAL SUBGRADE SHALL BE THOROUGHLY PROOFROLLED UNDER THE OBSERVATION OF A GEOTECHNICAL/PAVEMENT ENGINEER. LOOSE OR YIELDING AREAS WHICH CANNOT BE MECHANICALLY STABILIZED SHALL BE REMOVED AND REPLACED WITH ENGINEERED FILL OR AS DICTATED BY FIELD CONDITIONS.
6. THE AGGREGATE BASE SHALL BE COMPACTED TO A DENSITY NO LESS THAN 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE MODIFIED PROCTOR (ASTM D 1557-91). THE BASE SHALL EXTEND A MINIMUM OF 1 FOOT BEYOND THE PAVED EDGE.
7. ALL BITUMINOUS MATERIAL SHALL BE COMPACTED TO A DENSITY NO LESS THAN 97 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE MARSHALL METHOD.
8. A BOND COAT OF SS-1H EMULSION IS REQUIRED BETWEEN THE LEVELING COURSE AND THE WEARING COURSE WHEN EITHER 24 HOURS HAVE ELAPSED BETWEEN PLACEMENT OF THE BITUMINOUS COURSES OR THE SURFACE OF THE PAVEMENT HAS BEEN CONTAMINATED WITH DIRT, DUST, OR FOREIGN MATERIAL. THE BOND COAT SHALL BE APPLIED IN A UNIFORM MANNER OVER THE SURFACE AT A RATE OF 0.1 GALLONS/S.Y. IN THE EVENT A BOND COAT IS NOT REQUIRED, THE LEVELING COURSE MAY REQUIRE LOCALIZED BROOM CLEANING.
9. PERFORMANCE GRADE PG64-28 ASPHALT CEMENT SHALL BE USED IN THE PRODUCTION OF ALL BITUMINOUS MIXTURES. RECLAIMED ASPHALT PAVEMENT (RAP) SHALL BE ALLOWED ONLY AS SPECIFIED BY THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, UNLESS NOTED ON THE PROJECT DETAILS.
10. CONSTRUCTION TRAFFIC SHALL BE MINIMIZED ON THE NEW PAVEMENT. IF CONSTRUCTION TRAFFIC IS ANTICIPATED ON THE PAVEMENT STRUCTURE, THE PLACEMENT OF THE FINAL LIFT SHALL BE DELAYED UNTIL THE MAJORITY OF THE CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED. THIS ACTION WILL ALLOW REPAIR OF LOCALIZED FAILURE, IF ANY DOES OCCUR, AS WELL AS REDUCE LOAD DAMAGE ON THE PAVEMENT SYSTEM. THE CONTRACTOR IS RESPONSIBLE FOR REPAIR TO ANY DAMAGED SECTION RESULTING FROM CONSTRUCTION ACTIVITY.
11. TAPER CURB HEIGHT DOWN TO ZERO HEIGHT IN FIVE FEET AT ALL CURB ENDINGS UNLESS OTHERWISE NOTED ON THE PLAN.
12. WHERE CURB AND GUTTER SECTION IS ADJACENT TO A BARRIER FREE RAMP, DROP CURB HEIGHT TO MAXIMUM 1/4" ACROSS THE RAMP OPENING.
13. DIRECTIONAL ARROW PAVEMENT MARKINGS AND PAVEMENT MARKING LETTERING WHERE INDICATED SHALL BE WHITE PREFORMED THERMOPLASTIC UNLESS OTHERWISE NOTED. INSTALLATION OF THESE PERMANENT PAVEMENT MARKINGS SHALL BE PERFORMED PER THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION SECTIONS 811 AND 920.
14. CONTRACTOR SHALL PROTECT EXISTING CURB, GUTTER, SIDEWALK, WALLS, FENCES AND ALL OTHER EXISTING SITE FEATURES NOT INDICATED FOR REMOVAL OR REHABILITATION.
15. PLACE EXPANSION JOINTS WHERE NEW CONCRETE PAVEMENT OR WALKS ABUT BUILDING WALLS (PROPOSED OR EXISTING), COLUMN WALLS OR BASES, CONCRETE FOUNDATIONS OR BASES, CURBS, OR EXISTING CONCRETE PAVEMENT. PLACE JOINT SEALANT ON ALL EXPANSION JOINTS.
16. CONTRACTOR TO CONSTRUCT CONTRACTION AND EXPANSION JOINTS IN ALL NEW CONCRETE PAVEMENT. CONTRACTION JOINTS SHALL BE TOOLED WHERE SIDEWALK WIDTH IS 8' OR LESS, AND SHALL BE SPACED EQUAL TO THE WIDTH OF THE PAVEMENT (I.E. 8' SPACING FOR 8' WIDE WALK), BUT NOT MORE THAN 10' APART. PLACE EXPANSION JOINTS WITH JOINT SEALANT AT MAXIMUM 50' SPACING. CONTRACTOR SHALL GENERALLY MATCH THE JOINT PATTERNS FOR CONCRETE PAVEMENT WHEN SHOWN ON THE PLANS.
17. WHERE THESE PLANS DIFFER FROM THE STANDARD DETAILS OR STANDARD SPECIFICATIONS OF THE COMMUNITY, THE COMMUNITY REQUIREMENTS SHALL GOVERN.
18. CONCRETE PAVEMENT SHALL MEET THE REQUIREMENTS FOR MDOT GRADE 4000 CONCRETE PER THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.

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Willow School

Lansing School District

1012 W. Willow
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Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024
PR - #1	04.18.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

PAVING PLAN

SHEET NO.

C4.1

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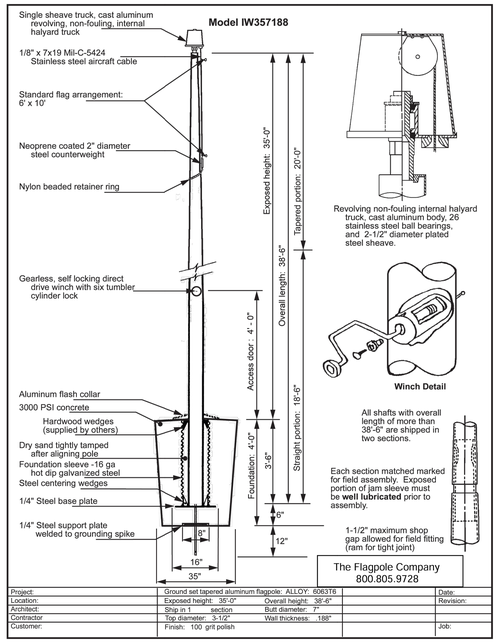
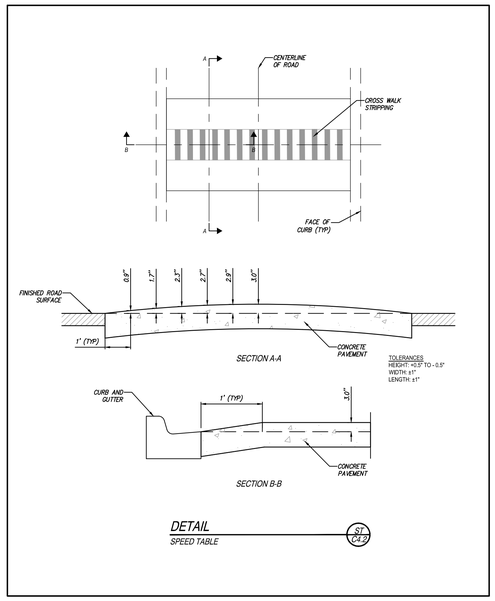
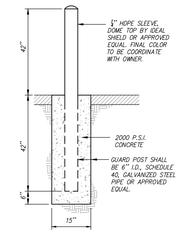


Project:	Ground set tapered aluminum flagpole: ALLOY: 6063T6		Date:
Location:	Exposed height: 35'-0"	Overall height: 38'-6"	Revision:
Architect:	Ship in 1 section	Butt diameter: 7"	
Contractor	Top diameter: 3-1/2"	Wall thickness: .188"	
Customer:	Finish: 100 grit polish		Job:

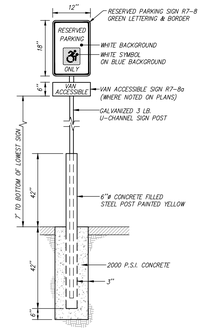
SECTION FLAGPOLE — FP C4.2



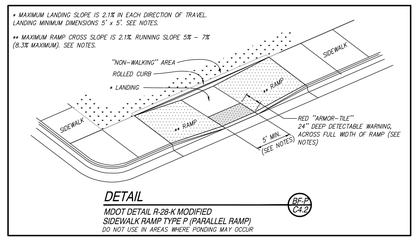
DETAIL SPEED TABLE — ST C4.2



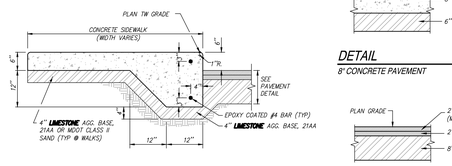
DETAIL BOLLARD DETAIL — B C4.2



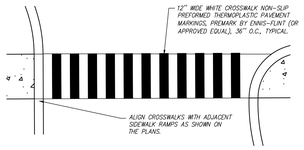
DETAIL BARRIER FREE SIGN IN PAVEMENT DETAIL — BF-R C4.2



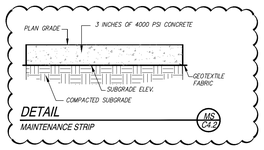
DETAIL
MDOT DETAIL R-28-K MODIFIED
SIDEWALK RAMP TYPE P (PARALLEL RAMP)
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR
BF-P C4.2



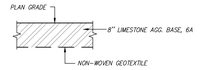
SECTION INTEGRAL WALK/CURB — X-1 C4.2



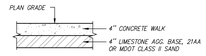
DETAIL CROSSWALK — CW C4.2



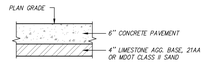
DETAIL MAINTENANCE STRIP — MS C4.2



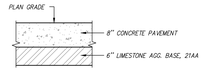
DETAIL STANDARD GRAVEL — GS C4.2



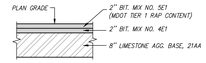
DETAIL 4' CONCRETE WALK — CW-4 C4.2



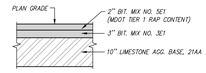
DETAIL 6' CONCRETE WALK — CP-6 C4.2



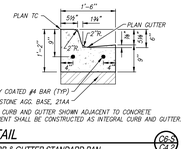
DETAIL 8' CONCRETE PAVEMENT — CP-8 C4.2



DETAIL STANDARD BITUMINOUS PAVEMENT — AP-S C4.2

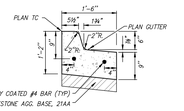


DETAIL HEAVY DUTY BITUMINOUS PAVEMENT — AP-H C4.2

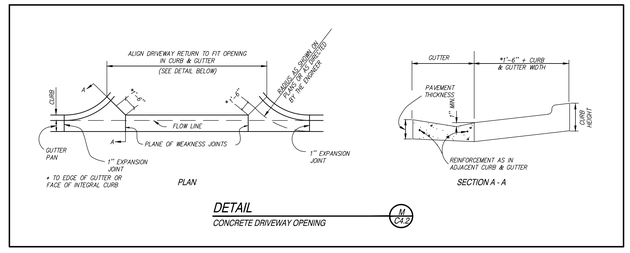


NOTE: CURB AND GUTTER SHOWN ADJACENT TO CONCRETE PAVEMENT SHALL BE CONSTRUCTED AS INTEGRAL CURB AND GUTTER.

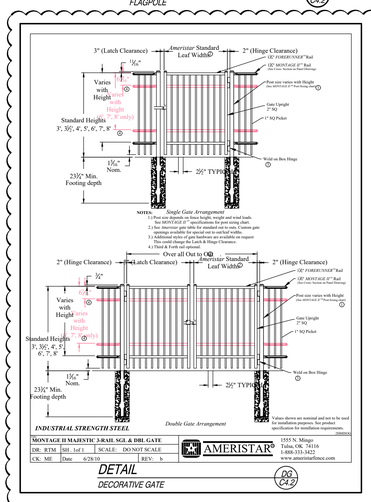
DETAIL 6' CURB & GUTTER STANDARD PAN (MDOT TYPE F1) — CG-S C4.2



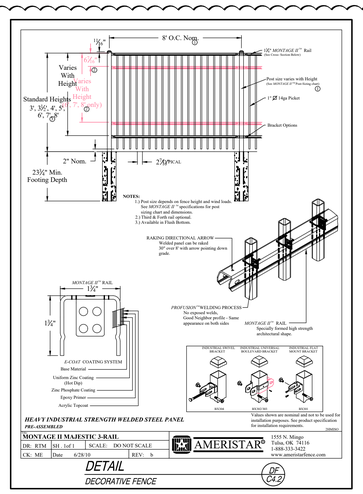
DETAIL 6' CURB & GUTTER REVERSE PAN (MDOT TYPE F1) — CG-R C4.2



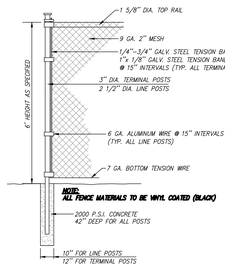
DETAIL CONCRETE DRIVEWAY OPENING — M C4.2



DETAIL DECORATIVE GATE — DG C4.2



DETAIL DECORATIVE FENCE — DF C4.2



NOTE:
TERMINAL POSTS INCLUDE END, COVER, ANGLE, INTERSECTION AND INTERMEDIATE BRACED POSTS.

DETAIL STANDARD 6' CHAIN LINK FENCE — F C4.2

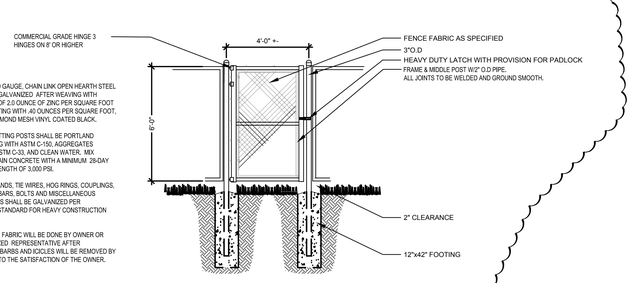
CHAIN LINK FENCE

FABRIC SHALL BE #9 GAUGE, CHAIN LINK OPEN HEARTH STEEL WIRE, HOT-DIPPED GALVANIZED AFTER WEAVING WITH MINIMUM COATING OF 2.0 OUNCE OF ZINC PER SQUARE FOOT OR ALUMINUM COATING WITH .40 OUNCES PER SQUARE FOOT, WOVEN IN 1 1/2" DIAMOND MESH VINYL COATED BLACK.

CONCRETE FOR SETTING POSTS SHALL BE PORTLAND CEMENT COMPLYING WITH ASTM C-150, AGGREGATES COMPLYING WITH ASTM C-33, AND CLEAN WATER. MIX MATERIALS TO OBTAIN CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3,000 PSI.

STRETCHER BAR BANDS, TIE WIRES, HOG RINGS, COUPLINGS, NUTS, STRETCHER BARS, BOLTS AND MISCELLANEOUS FASTENING DEVICES SHALL BE GALVANIZED PER MANUFACTURER'S STANDARD FOR HEAVY CONSTRUCTION FENCE.

INSPECTION OF THE FABRIC WILL BE DONE BY OWNER OR OWNER'S AUTHORIZED REPRESENTATIVE AFTER INSTALLATION. ALL BARBS AND ICICLES WILL BE REMOVED BY THE CONTRACTOR TO THE SATISFACTION OF THE OWNER.



DETAIL STANDARD 6' CHAIN LINK FENCE GATE — G C4.2

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Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

PAVING DETAILS

SHEET NO.

C4.2

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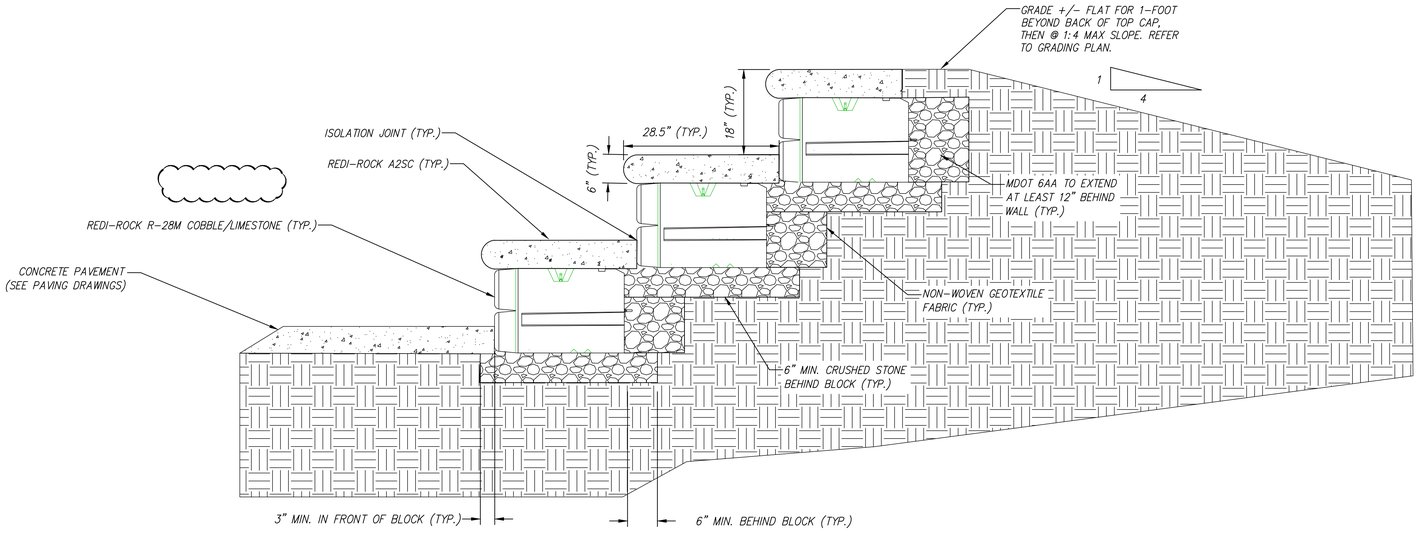
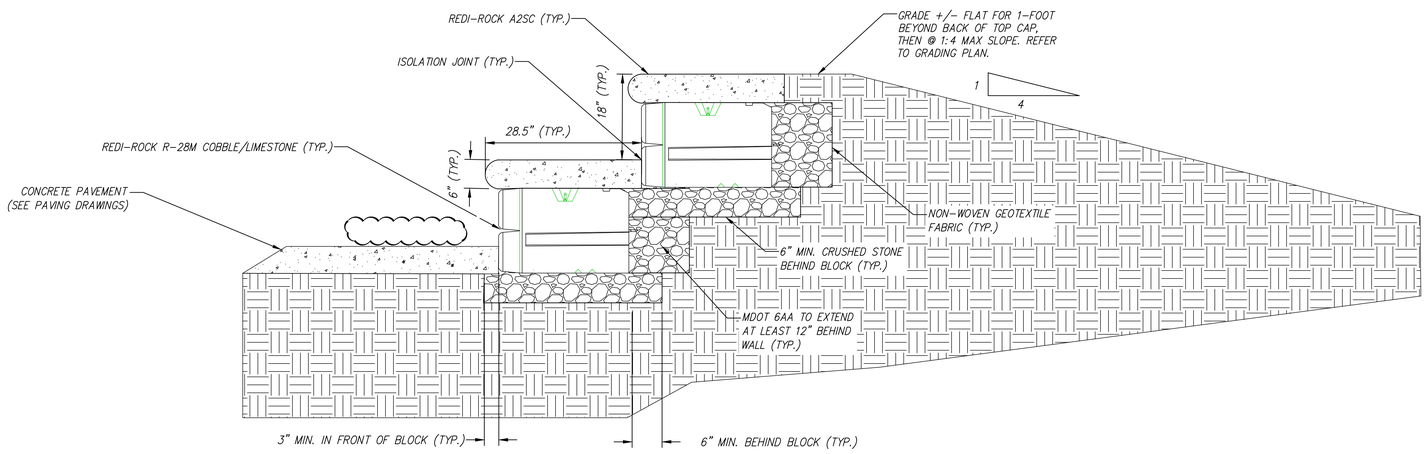


TYPICAL 3 ROW SEATING CROSS SECTION



TYPICAL 2 ROW SEATING CROSS SECTION

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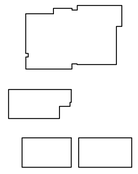

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

AMPHITHEATER EXHIBIT

SHEET NO.
C4.3

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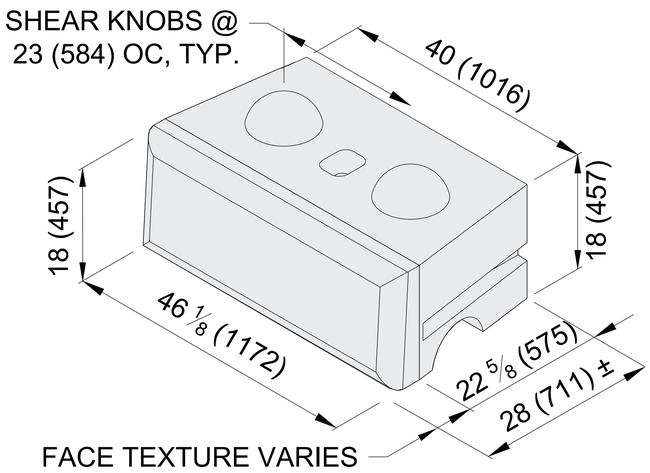
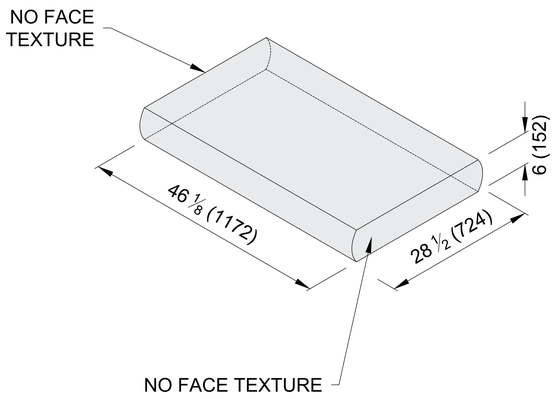
R-28M 28" (710mm) MIDDLE

Face Texture:	Cobble / Limestone	Kingstone / Ledgestone
Block Weight:	1610 lb (730 kg)	1540 lb (700 kg)
Block Volume:	11.28 ft^3 (0.319 m^3)	10.78 ft^3 (0.305 m^3)
Center of Gravity:	13.9" (354 mm)	13.4" (340 mm)



A-2SC TWO-SIDED CAP

Block Weight:	630 lb (290 kg)
Block Volume:	4.42 ft^3 (0.125 m^3)



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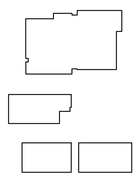
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024



KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

AMPHITHEATER EXHIBIT

SHEET NO.

C4.4

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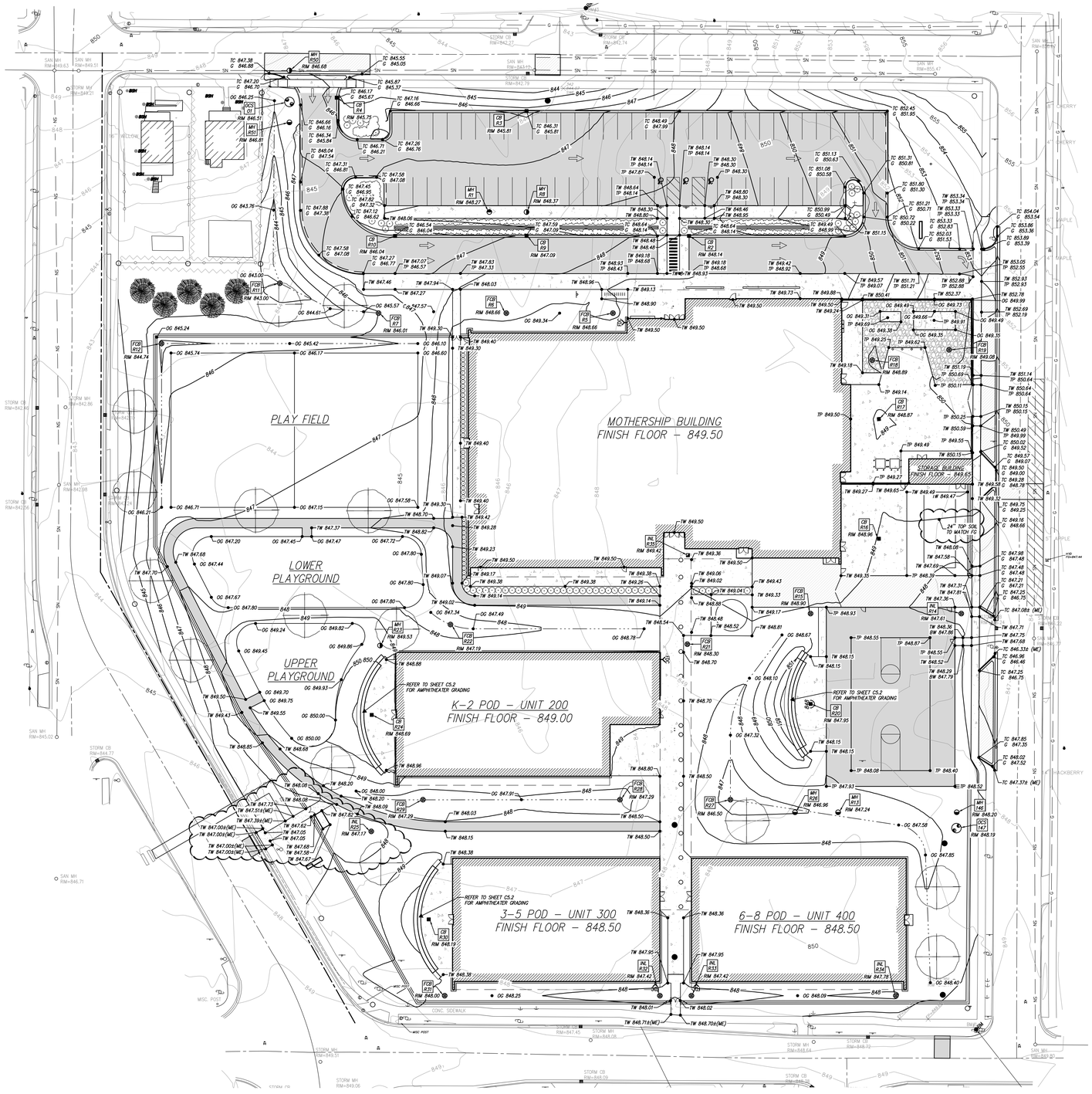

GRAPHIC SCALE

0 15 30 60

(IN FEET)
1 inch = 30 ft.

GRADING LEGEND

850.00	EXISTING ELEVATION
• TC 000.00 G 000.00	PROPOSED TOP OF CURB ELEVATION PROPOSED GUTTER ELEVATION
• OG 000.00	OUTSIDE GRADE ELEVATION
11.30 11.31	EXISTING CONTOURS
11.30	PROPOSED CONTOURS
• TP 000.00	TOP OF PAVEMENT ELEVATION
• TW 000.00	TOP OF WALK ELEVATION
• FG 000.00	FINISH GRADE ELEVATION
• T/WALL 000.00	TOP OF WALL ELEVATION
• ME 000.00	MATCH EXISTING ELEVATION
	FLOW ARROW

LEGEND

- PROPOSED WATERMAIN
- PROPOSED SANITARY
- PROPOSED STORM SEWER
- PROPOSED GAS MAIN
- PROPOSED ELECTRIC
- PROPOSED HYDRANT
- PROPOSED GATE VALVE & WELL (GVW)
- PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)
- STANDARD BITUMINOUS PAVEMENT
- HEAVY-DUTY BITUMINOUS PAVEMENT
- DEEP-STRENGTH BITUMINOUS PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK
- MILL PAVEMENT
- PROPOSED SAN MANHOLE (SAN)
- PROPOSED STORM MANHOLE (MH)
- PROPOSED CATCH BASIN (CB)
- PROPOSED INLET (INL)
- PROPOSED END SECTION (ES)
- PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
- 2 UTILITY CROSSING (SEE DATA TABLE)
- STORM SEWER STRUCTURE: CB 2 — STRUCT. TYPE, STRUCT. NO.
- SANITARY SEWER STRUCTURE: 20
- WATERMAIN STRUCTURE: 10 XXX — STRUCT. NO., STRUCT. TYPE

GRADING LEGEND

850.00	EXISTING ELEVATION
• TC 000.00 G 000.00	PROPOSED TOP OF CURB ELEVATION PROPOSED GUTTER ELEVATION
• OG 000.00	OUTSIDE GRADE ELEVATION
11.30 11.31	EXISTING CONTOURS
11.30	PROPOSED CONTOURS
• TP 000.00	TOP OF PAVEMENT ELEVATION
• TW 000.00	TOP OF WALK ELEVATION
• FG 000.00	FINISH GRADE ELEVATION
• T/WALL 000.00	TOP OF WALL ELEVATION
• ME 000.00	MATCH EXISTING ELEVATION
	FLOW ARROW

GRADING NOTES

1. CONTRACTOR TO PLACE ALL NEW PAVEMENT TO THE GRADES INDICATED, OR MATCH ORIGINAL GRADES IF NEW GRADES ARE NOT SHOWN. CONTRACTOR SHALL CONFIRM MINIMUM 1% PAVEMENT SLOPES ARE ATTAINED IN ALL AREAS.
2. PROPOSED GRADES MAY BE BASED ON AN INTERPOLATION OF DATA SHOWN ON THE TOPOGRAPHIC SURVEY. THIS INTERPOLATED DATA IS APPROXIMATE AND COULD DIFFER SLIGHTLY BASED ON THE ACCURACY OF THE SURVEY. CONTRACTOR SHALL CONFIRM THAT THE PROPOSED GRADES SHOWN ON THIS PLAN WILL NOT CREATE A STANDING WATER CONDITION (I.E. A LOW SPOT OR PAVEMENT SLOPES LESS THAN 1%) OR AN UNSAFE CONDITION WITH SLOPES IN EXCESS OF 5%. CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY IF THEY BELIEVE THAT ONE OF THESE SITUATIONS WILL OCCUR BASED ON THE PROPOSED GRADES.
3. ALL HANDICAP RAMPS AND ADA ACCESSIBLE ROUTES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT VERSION OF MDOT DETAIL R-28 "SIDEWALK RAMP AND DETECTABLE WARNING DETAILS".
4. CONTRACTOR IS RESPONSIBLE FOR CONTROLLING STORM WATER RUNOFF DURING CONSTRUCTION OPERATIONS. OF PARTICULAR CONCERN WILL BE THE TIME PERIOD AFTER THE SITE HAS BEEN STRIPPED AND NOT YET RESTORED, BUILT UPON, OR PAVED. CONTRACTOR MUST INSTALL OR CONSTRUCT APPROPRIATE TEMPORARY MEASURES TO PROTECT ADJACENT PROPERTIES.

RESTORATION NOTE

RESTORE ALL DISTURBED LAWN AREAS PER LANDSCAPE PLANS AND SPECIFICATIONS FOR LAWN RESTORATION REQUIREMENTS.

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Lansing School District

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Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

GRADING PLAN

SHEET NO.

C5.1

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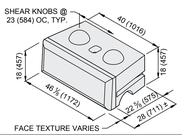
REDI-ROCK BLOCK DETAILS

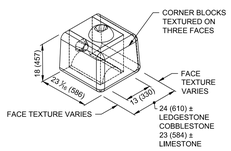
R-28M 28" (710mm) MIDDLE

	Cobble / Limestone	Kingstone / Ledgestone
Face Texture:	Cobble / Limestone	Kingstone / Ledgestone
Block Weight:	1610 lb (730 kg)	1540 lb (700 kg)
Block Volume:	11.28 ft³ (0.319 m³)	10.78 ft³ (0.305 m³)
Center of Gravity:	13.9" (354 mm)	13.4" (340 mm)



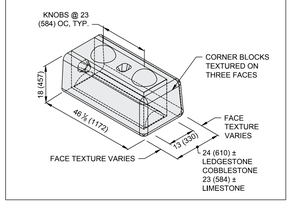
F-HCM HALF CORNER MIDDLE

	Cobble / Limestone	Kingstone / Ledgestone
Face Texture:	Cobble / Limestone	Kingstone / Ledgestone
Block Weight:	660 lb (300 kg)	650 lb (300 kg)
Block Volume:	4.6 ft³ (0.13m³)	4.6 ft³ (0.13m³)



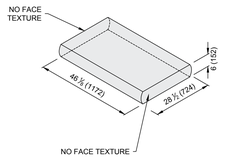
F-CM CORNER MIDDLE

	Cobble / Limestone	Kingstone / Ledgestone
Face Texture:	Cobble / Limestone	Kingstone / Ledgestone
Block Weight:	1370 lb (620 kg)	1360 lb (620 kg)
Block Volume:	9.6 ft³ (0.27m³)	9.5 ft³ (0.27m³)



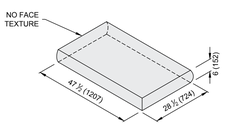
A-2SC TWO-SIDED CAP

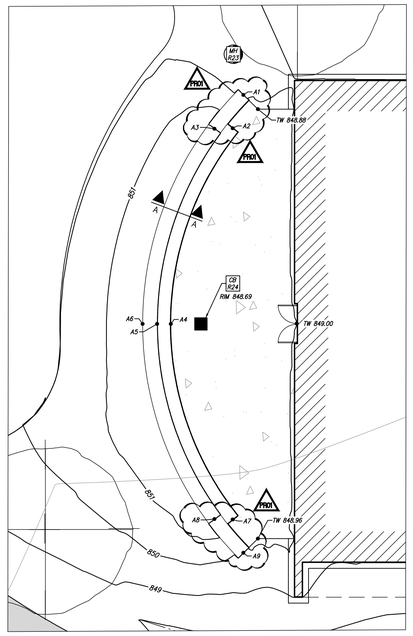
Block Weight: 630 lb (290 kg)
Block Volume: 4.42 ft³ (0.125 m³)



A-3SC THREE-SIDED CAP

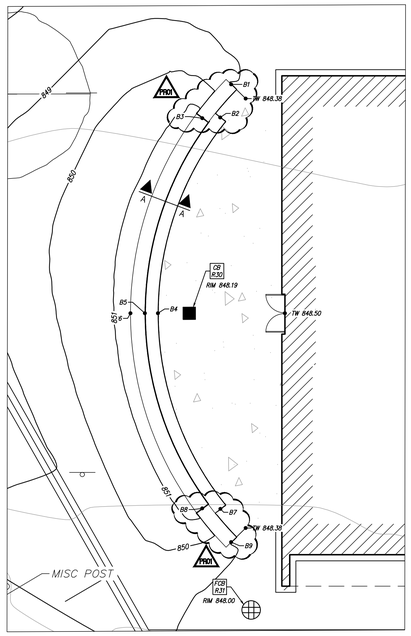
Block Weight: 660 lb (300 kg)
Block Volume: 4.59 ft³ (0.130 m³)





AMPHITHEATER - A
DETAIL GRADING

AMPHITHEATER GRADES		
A1	TOP	850.50
	BOTTOM	849.50
A2	TOP	850.50
	BOTTOM	849.00
A3	TOP	852.00
	BOTTOM	850.50
A4	TOP	850.50
	BOTTOM	849.00
A5	TOP	852.00
	BOTTOM	850.50
A6	TOP	852.00
	BOTTOM	852.00
A7	TOP	850.50
	BOTTOM	849.00
A8	TOP	852.00
	BOTTOM	850.50
A9	TOP	850.50
	BOTTOM	849.50



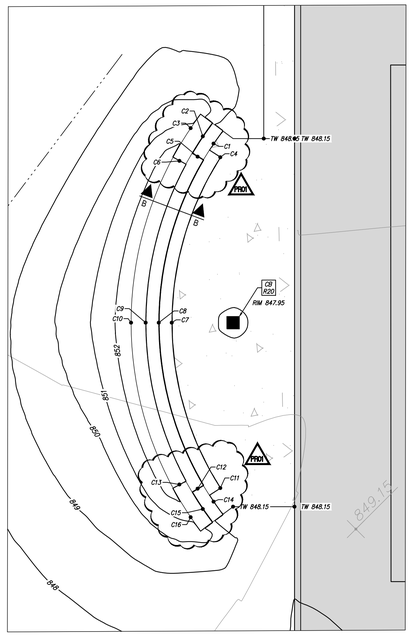
AMPHITHEATER - B
DETAIL GRADING

AMPHITHEATER GRADES		
B1	TOP	850.00
	BOTTOM	848.92
B2	TOP	850.00
	BOTTOM	848.50
B3	TOP	851.50
	BOTTOM	850.00
B4	TOP	850.00
	BOTTOM	848.50
B5	TOP	851.50
	BOTTOM	850.00
B6	TOP	851.50
	BOTTOM	851.50
B7	TOP	850.00
	BOTTOM	848.50
B8	TOP	851.50
	BOTTOM	850.00
B9	TOP	850.00
	BOTTOM	848.92

GRAPHIC SCALE
0 15 30 60
(IN FEET)
1 inch = 30 ft.

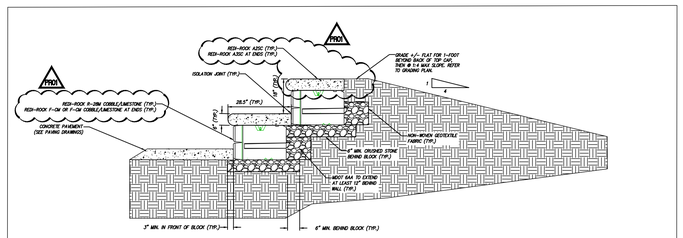
GRADING LEGEND

000.00	EXISTING ELEVATION
• TC 000.00 • G 000.00	PROPOSED TOP OF CURB ELEVATION PROPOSED GUTTER ELEVATION
• OG 000.00	OUTSIDE GRADE ELEVATION
11.50	EXISTING CONTOURS
11.31	
11.30	PROPOSED CONTOURS
• TP 000.00	TOP OF PAVEMENT ELEVATION
• TW 000.00	TOP OF WALK ELEVATION
• FG 000.00	FINISH GRADE ELEVATION
• T/WALL 000.00	TOP OF WALL ELEVATION
• ME 000.00	MATCH EXISTING ELEVATION
	FLOW ARROW

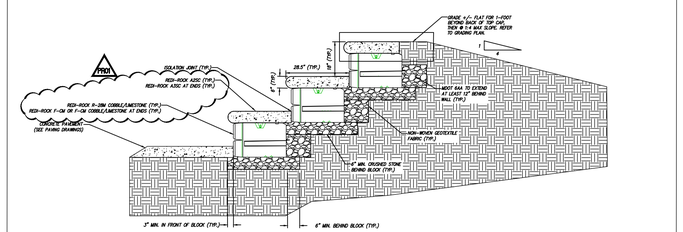


AMPHITHEATER - C
DETAIL GRADING

AMPHITHEATER GRADES		
C1	TOP	849.65
	BOTTOM	848.15
C2	TOP	851.15
	BOTTOM	849.65
C3	TOP	851.15
	BOTTOM	851.15
C4	TOP	849.65
	BOTTOM	848.15
C5	TOP	851.15
	BOTTOM	849.65
C6	TOP	852.65
	BOTTOM	851.15
C7	TOP	849.65
	BOTTOM	848.15
C8	TOP	851.15
	BOTTOM	849.65
C9	TOP	852.65
	BOTTOM	851.15
C10	TOP	852.65
	BOTTOM	852.65
C11	TOP	849.65
	BOTTOM	848.15
C12	TOP	851.15
	BOTTOM	849.65
C13	TOP	852.65
	BOTTOM	851.15
C14	TOP	849.65
	BOTTOM	848.15
C15	TOP	851.15
	BOTTOM	849.65
C16	TOP	851.15
	BOTTOM	851.15



AMPHITHEATER
A-A SECTION



AMPHITHEATER
B-B SECTION

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ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024
PR - #1	04.18.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

GRADING PLAN

SHEET NO.

C5.2

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STORM STRUCTURE SCHEDULE

STR. NO.	TYPE	RIM ELEV.	INV. SIZE	INV. DIR.	INVERT	IN/OUT
R1	4' DIA MANHOLE	848.27	18" 24" 18"	E W N	838.00' 837.84' 838.88'	In Out In
R2	4' DIA CATCH BASIN	848.14	12"	W	844.24'	Out
R3	4' DIA CATCH BASIN	845.81	12" 12"	W S	841.28' 841.28'	In Out
R4	4' DIA CATCH BASIN	845.75	12"	E	841.88'	Out
R5	4' DIA FIELD CATCH BASIN	848.66	12"	W	842.96'	Out
R6	4' DIA FIELD CATCH BASIN	848.66	12" 12" 12"	W N E	841.61' 841.61' 841.61'	In Out In
R7	4' DIA FIELD CATCH BASIN	846.01	12"	E	842.42'	Out
R8	4' DIA MANHOLE	848.37	18" 12" 18"	S N W	838.24' 840.00' 838.24'	In In Out
R9	4' DIA CATCH BASIN	847.09	18" 18" 12" 12"	W N S E	838.31' 838.31' 841.10' 843.90'	In Out In In
R10	4' DIA CATCH BASIN	846.04	12" 18"	W E	838.99' 838.59'	In Out
R11	4' DIA FIELD CATCH BASIN	843.00	12" 12"	SW E	839.38' 839.38'	In Out
R12	4' DIA FIELD CATCH BASIN	844.74	12"	NE	839.80'	Out
R50	4' DIA MANHOLE	846.68	18" 24" 24"	S E W	837.34' 836.80' 836.80'	In Out In
R51	5' DIA MANHOLE	846.81	24" 24" 8" 24"	N E NE S	836.92' 837.84' 836.92' 837.84'	Out Out In Out

STORM STRUCTURE SCHEDULE

STR. NO.	TYPE	RIM ELEV.	INV. SIZE	INV. DIR.	INVERT	IN/OUT
146	4' DIA MANHOLE	848.20	12" 24" 24"	S W N	840.40' 840.57' 840.57'	Out Out Out
R13	4' DIA MANHOLE	847.24	18" 24" 18"	W N E	840.57' 840.57' 840.65'	In Out Out
R14	2' DIA INLET CB	847.61	12"	W	844.38'	Out
R15	4' DIA FIELD CATCH BASIN	848.90	12" 12" 12"	NE S E	843.42' 843.42' 843.42'	In Out In
R16	4' DIA CATCH BASIN	848.96	12" 12"	N SW	845.02' 845.02'	In Out
R17	4' DIA CATCH BASIN	848.87	12" 12"	N S	845.27' 845.27'	In Out
R18	4' DIA FIELD CATCH BASIN	848.89	12" 12"	E S	845.39' 845.39'	In Out
R19	4' DIA FIELD CATCH BASIN	849.08	12"	W	845.56'	Out
R20	4' DIA CATCH BASIN	847.95	12" 18" 12"	NW S N	841.99' 841.59' 841.99'	In Out In
R21	4' DIA FIELD CATCH BASIN	848.30	12" 12" 8"	W SE N	842.86' 842.86' 843.06'	In Out In
R22	4' DIA FIELD CATCH BASIN	847.19	12" 12" 8" 8"	W E NE NW	843.61' 843.61' 843.55' 843.61'	In Out In In
R23	4' DIA MANHOLE	849.53	12" 12" 8"	S E W	844.31' 844.31' 844.31'	In Out In
R24	4' DIA CATCH BASIN	848.69	12"	N	844.53'	Out
R25	2' DIA INLET CB	847.17	12"	NE	843.82'	Out

STORM STRUCTURE SCHEDULE

STR. NO.	TYPE	RIM ELEV.	INV. SIZE	INV. DIR.	INVERT	IN/OUT
R26	5' DIA MANHOLE	846.96	18" 18" 18"	W E N	840.90' 840.90' 840.90'	In Out In
R27	4' DIA FIELD CATCH BASIN	846.50	18" 18"	W E	842.37' 842.37'	In Out
R28	4' DIA FIELD CATCH BASIN	847.29	12" 12" 6"	W E NW	843.00' 842.60' 844.74'	In Out In
R29	4' DIA FIELD CATCH BASIN	847.29	12" 12" 12" 6"	S E SW NW	843.63' 843.63' 843.63' 844.73'	In Out In In
R30	4' DIA CATCH BASIN	848.19	12" 12"	S N	844.38' 844.38'	In Out
R31	4' DIA FIELD CATCH BASIN	848.00	12" 12"	N E	844.88' 844.09'	Out In
R32	2' DIA INLET CB	847.42	12" 12"	W E	844.54' 844.54'	Out In
R33	2' DIA INLET CB	847.42	12" 12"	W E	844.61' 844.61'	Out In
R34	2' DIA INLET CB	847.78	12" 6"	W NE	845.04' 845.04'	Out In
R35	2' DIA INLET	849.42	8" 6" 6" 6"	S E W N	844.19' 844.19' 844.70' 844.92'	Out In In In

SANITARY STRUCTURE SCHEDULE

STR. NO.	TYPE	RIM ELEV.	INV. SIZE	INV. DIR.	INVERT	IN/OUT
S1	4' DIA MANHOLE	848.89	8" 8"	N S	838.98' 838.88'	In Out
S2	4' DIA MANHOLE	846.03	8" 8"	W S	839.56' 839.46'	In Out
S3	4' DIA MANHOLE	848.50	8" 6" 6"	E S N	840.42' 840.58' 841.48'	Out In Out
S4	4' DIA MANHOLE	848.11	6" 4" 4"	N E W	843.93' 844.03' 844.03'	Out In In
S5	4' DIA MANHOLE	845.34	6" 6" 6"	N SE SE	836.64' 836.74' 836.51'	Out In In

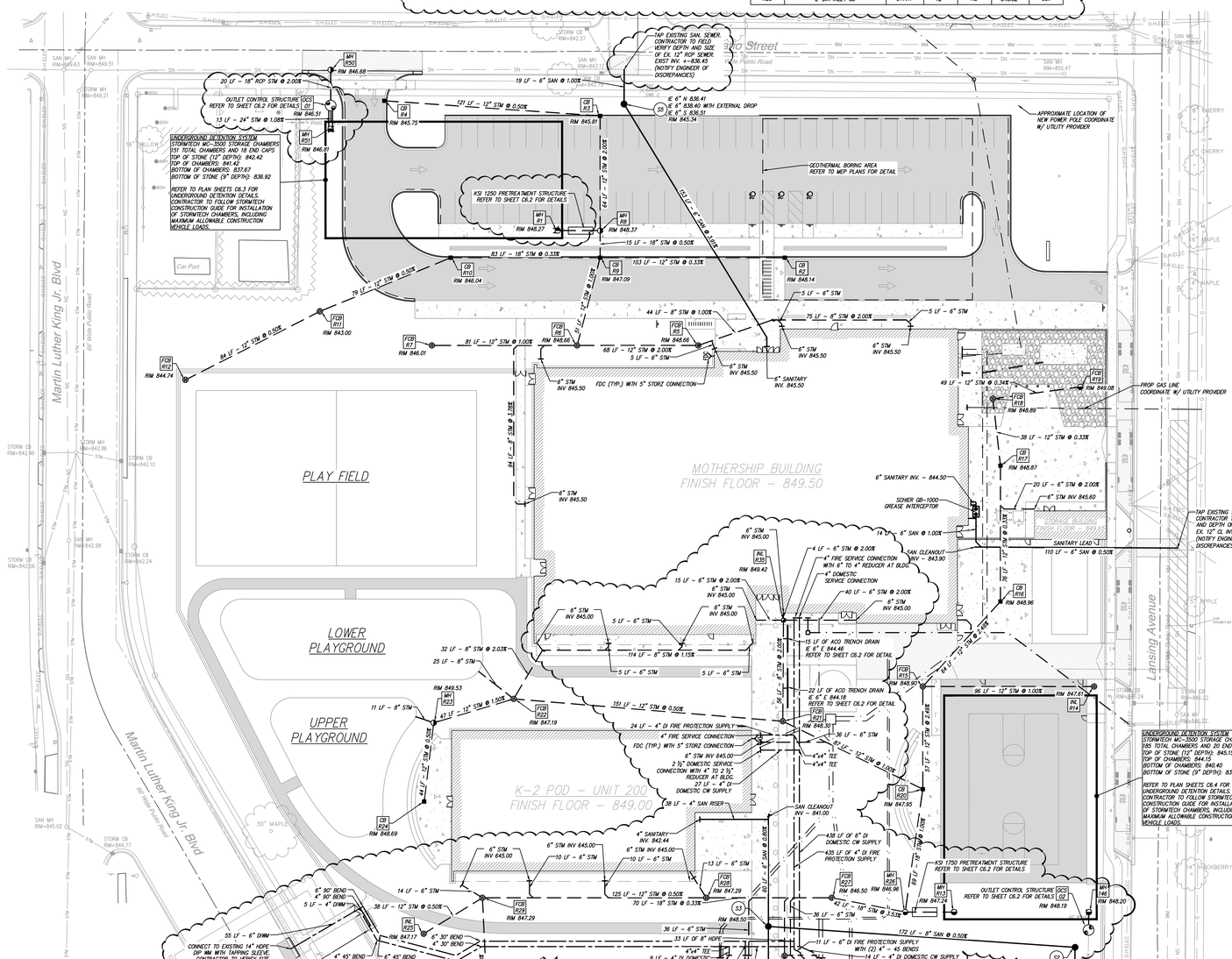
RIM ADJUSTMENT NOTE

REMOVE EXISTING CASTING, COVER AND ADJUSTMENT MATERIALS FROM STRUCTURE. SALVAGE CASTING AND COVER FOR REINSTALLATION AND PROVIDE NEW ADJUSTMENT BRICK/BLOCK/RINGS. REINSTALL ACCORDING TO STANDARD DETAILS (IF INCLUDED). PROTECT EXISTING UTILITY STRUCTURE TO REMAIN.

GRAPHIC SCALE

0 15 30 60

(IN FEET)
1 inch = 30 ft.

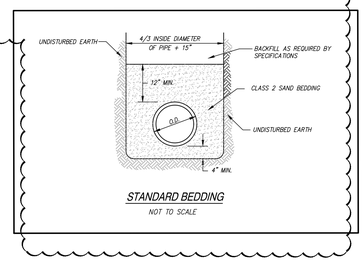


LEGEND

- PROPOSED WATERMAIN
- PROPOSED SANITARY
- PROPOSED STORM SEWER
- PROPOSED GAS MAIN
- PROPOSED ELECTRIC
- PROPOSED HYDRANT
- PROPOSED GATE VALVE & WELL (GVW)
- PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)
- PROPOSED SAN MANHOLE (SAN)
- PROPOSED STORM MANHOLE (MH)
- PROPOSED CATCH BASIN (CB)
- PROPOSED INLET (INL)
- PROPOSED END SECTION (ES)
- PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
- STANDARD BITUMINOUS PAVEMENT
- HEAVY-DUTY BITUMINOUS PAVEMENT
- DEEP-STRENGTH BITUMINOUS PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK
- MILL PAVEMENT
- UTILITY CROSSING (SEE DATA TABLE)
- STORM SEWER STRUCTURE: STRUCT. TYPE (CB), STRUCT. NO.
- SANITARY SEWER STRUCTURE: 20
- WATERMAIN STRUCTURE: STRUCT. NO. 10, STRUCT. TYPE XXX

UTILITY NOTES

1. STORM SEWER 6" AND SMALLER SHALL BE PVC SDR 23.5. STORM SEWER GREATER THAN 6" THROUGH 10" SHALL BE PVC SDR 26. WHERE STORM SEWER 12" AND LARGER IS NOTED AS PVC, PIPE SHALL BE SCHEDULE 40 PVC.
2. WHERE NOTED AS HDPE, STORM SEWER SHALL BE HDPE SMOOTH INTERIOR CORRUGATED PIPE MEETING AASHTO STANDARD M294M–99, UNLESS OTHERWISE NOTED ON PLAN. WHERE NOTED AS RCP, STORM SEWER SHALL BE C76 CL IV (PREM.JT.). INSTALLATION SHALL ADHERE TO ASTM D2321 SPECIFICATION. AFTER INSTALLATION, PIPE SHALL BE CHECKED FOR DEFLECTION BY A METHOD APPROVED BY THE PIPE MANUFACTURER. ANY PIPE DEFLECTION EXCEEDING THE ALLOWABLE MAXIMUM MUST BE REMOVED AND REPLACED.
3. SANITARY SEWER 8" AND LARGER SHALL BE PVC SDR 23.5 PIPE. LEADS 6" AND SMALLER SHALL BE SOLID WALL, PVC, SDR 23.5.
4. WATER MAIN SHALL BE CLASS 52 DUCTILE IRON. WATER MAINS SHALL BE LEAKAGE AND PRESSURE TESTED IN ACCORDANCE WITH AWWA STANDARD C600. WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD C651 PRIOR TO BEING PUT INTO SERVICE.
5. ALL UTILITY TRENCHES THAT FALL WITHIN A 1–ON–1 INFLUENCE OF PAVEMENT AREAS SHALL BE BACKFILLED WITH CLASS 2 SAND AND COMPACTED TO 95% OF MAXIMUM DENSITY.
6. ALL WATER MAIN SHALL BE BURIED WITH 5' OF COVER FROM PROPOSED GRADES. USE 22.5° BENDS TO LOWER WATER MAIN AS NECESSARY AND/OR WHERE NOTED AT UTILITY CROSSING.
7. ALL PUBLIC UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE CITY OF ALLEN PARK AND/OR WAYNE COUNTY.
8. ALL UTILITIES SHALL BE INSTALLED ON CLASS "B" BEDDING (CLASS 2 SAND) OR BETTER.
9. STORM SEWER STRUCTURE DIAMETERS SHALL BE AS NOTED ON THE PLANS, UNLESS OTHERWISE INDICATED, CASTINGS SHALL BE:
   PVMT. CATCH BASINS – EJIW 5105 – "M1" (FRAMES WITH CURB BOXES WILL NOT BE ALLOWED)
   FIELD CATCH BASINS – EJIW 1040 – "D2"
   STORM MANHOLES – EJIW 1040 – "A"
10. SANITARY MANHOLE COVERS SHALL BE LABELED "SANITARY SEWER" ONLY FOR PRIVATE STRUCTURES. REFER TO CITY STANDARDS FOR REQUIRED TEXT OF UTILITY CASTINGS AT PUBLIC STRUCTURES.
11. LOCATIONS OF LIGHT POLES, IF SHOWN ON THESE DRAWINGS, MAY BE APPROXIMATE. CONFIRM EXACT LOCATION (I.E. CURB OFFSETS, SIDEWALK OFFSETS, ETC.) PRIOR TO STAKING AND CONSTRUCTION. REFER TO SITE ELECTRICAL PLAN FOR DETAILS, AND COORDINATE WITH ELECTRICAL ENGINEER, ARCHITECT, AND CIVIL ENGINEER TO DETERMINE PROPER PLACEMENT.
12. WHERE PUBLIC UTILITY WORK SHOWN ON THESE PLANS DIFFERS FROM THE STANDARD DETAILS OR STANDARD SPECIFICATIONS OF THE COMMUNITY, THE COMMUNITY REQUIREMENTS SHALL GOVERN.
13. HOT BOX – N–PATTERN VALVE DUAL ALUMINUM HEATED ENCLOSURE – HBKE–D"TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS. CONCRETE PAD TO MATCH SITE CONCRETE (CP–4). CONCRETE PAD TO BE 63" W X 124" LONG. CONCRETE PAD TO CONNECT TO FENCE MAINTENANCE STRIP AND INCLUDE AN ADDITIONAL 3' SIDEWALK ALONG THE FRONT OF THE ENCLOSURE AS SHOWN ON PLANS. SEE PLUMBING PLANS FOR INTERIOR DIAGRAM. COORDINATE WITH LBWL FOR THE INSTALLATION OF THE WATER METER. COORDINATE WITH ELECTRICAL PLANS.



STANDARD BEDDING

NOT TO SCALE

SPECIFICATIONS

Notes:
1. 6" plain end inlet/outlet
2. Unit weight - w/ cast iron covers: 824 lbs. (for wet weight add 8,413 lbs.)
3. Maximum operating temperature: 150° F continuous
4. Capacities - Liquid: 1,000 gal.;
   Grease: 5,496 lbs. (753 gal.) @100GPM
   Grease: 4,959 lbs. (679 gal.) @200GPM
   Solids: 211 gal.
5. Satisfies Miami DERM 99% efficiency requirements; retaining the following capacities at 99.0% efficiency:
   5,272 lbs. (722 gal.) @100GPM
   3,127 lbs. (428 gal.) @200GPM
6. For gravity drainage applications only.
7. Do not use for pressure applications.
8. Cover placement allows full access to tank for proper maintenance.
9. Vent not required unless per local code.
10. Engineered inlet and outlet diffusers with inspection ports are removable to inspect / clean piping.
11. Integral air relief / Anti-siphon / Sampling access.
12. Adjustable cover adapters provide up to 4" of additional height.
13. Designed for below-grade, above-grade, indoor or outdoor installations.
14. Safety Start®, access restrictor built into each cover adapter, prevents accidental entry to tanks (450 lb rating).

ENGINEER SPECIFICATION GUIDE

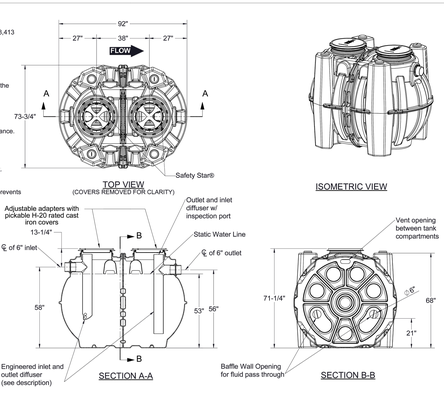
Schier Great Basin™ grease interceptor model # GB-1000 shall be lifetime guaranteed and made in USA of seamless, molded polyethylene with minimum 7/16" uniform wall thickness. Interceptor shall be furnished for above or below-grade installation with adjustable cover adapter and Safety Start® access restrictor built into each cover adapter. Interceptor shall be certified to ASME A112.14.3 (Type D) and CSA B481.1 as well as certified to IAPMO/ANSI Z1001-2021. Interceptor flow rate shall be 100 GPM or 200GPM. Interceptor grease capacity shall be 5,495 lbs. Cover shall provide watertgas-tight seal and have minimum 18,000 lbs. load capacity.

CERTIFIED PERFORMANCE

Great Basin™ hydromechanical grease interceptors are third party performance-tested and listed by IAPMO to ASME A112.14.3 and CSA B481.1 grease interceptor standards and greatly exceed requirements for grease separation and storage. They are compliant to the Uniform Plumbing Code and the International Plumbing Code.

Type D certification does not require a flow control

Satisfies Miami DERM 99% efficiency requirements. Product labels are permanently attached to inside and outside of unit for easy viewing.



SPECIFICATION SHEET

MODEL NUMBER:	PART NUMBER:	4080-002-01
GB-1000	DESCRIPTION:	GB-1000 GREASE INTERCEPTOR 100 GPM/ 200 GPM 6" INLET/OUTLET, H-20 RATED CAST IRON COVER
DWG BY: B.BROWN	DATE: 10/18/2021	REV: 02 ECO: 032822TA

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

UTILITY PLAN

SHEET NO.

C6.1

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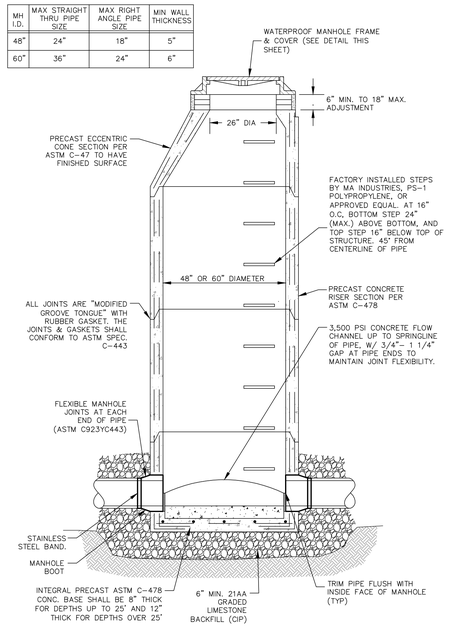
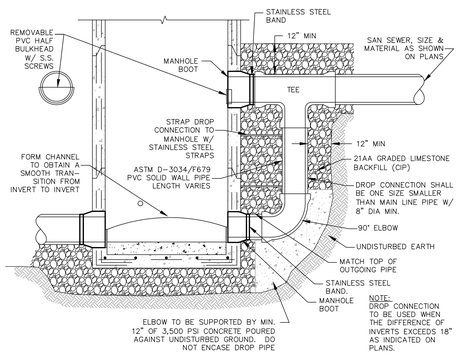
LAST PRINTED:

MH I.D.	MAX STRAIGHT THRU PIPE SIZE	MAX RIGHT ANGLE PIPE SIZE	MIN WALL THICKNESS
48"	24"	18"	5"
60"	36"	24"	6"



STANDARD SANITARY SEWER MANHOLE

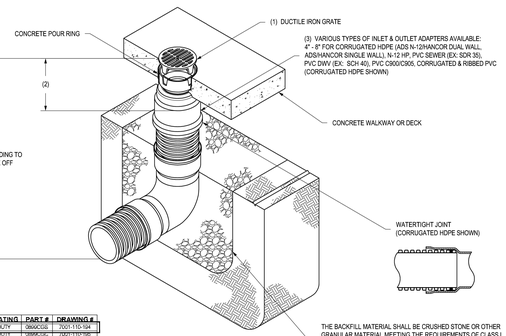
SCALE: NONE



EXTERIOR DROP ASSEMBLY (W/ SPECIAL APPROVAL)

SCALE: NONE

NYLOPLAST 8" INLINE DRAIN: 2708AG _ _ X



THE BACKFILL MATERIAL SHALL BE CRUSHED STONE OR OTHER GRANULAR MATERIAL MEETING THE REQUIREMENTS OF CLASS I, CLASS II, OR CLASS III MATERIAL AS DEFINED IN ASTM D2321. BEDDING & BACKFILL FOR SURFACE DRAINAGE INLETS SHALL BE PLACED & COMPACTED UNIFORMLY IN ACCORDANCE WITH ASTM D2321.

GRATE OPTIONS	LOAD RATING	PART #	DRAWING #
PEDESTRIAN(STANDARD)	LIGHT DUTY	0660CCG	7001-110-104
SLOT(OPTION)	LIGHT DUTY	0666CSG	7001-110-105
BRONZE	N/A	0690CGB	7001-110-106
DOME	N/A	0690CGD	7001-110-107

1 - GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05 WITH THE EXCEPTION OF THE BRONZE GRATE.
2 - FOR COMPLETE DESIGN DETAILS SEE DRAWING NO. 7003-110-000.
3 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), & PVC SEWER.

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DRAWN BY	EBC	MATERIAL	
DATE	11-15-06		
REVISED BY	NMH	PROJECT NO./NAME	
DATE	03-15-16		
DWG SIZE	A	SCALE 1:16	SHEET 1 OF 1

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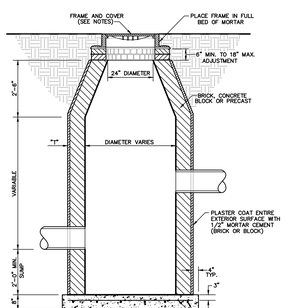
TITLE: 8 IN INLINE DRAIN QUICK SPEC INSTALLATION DETAIL

DWG NO. 7003-110-033 REV F

SPECIAL CATCH BASIN NOTES:

1. STEPS SHALL BE PLACED IN ALL 48" DIAMETER STRUCTURES MORE THAN 4' DEEP.



WALL THICKNESS "T"		
DEPTH	BRICK	PRECAST OR BLOCK
0'-10'	8"	6"
10'-16'	12"	8"

STORM SEWER CATCH BASIN

NO SCALE

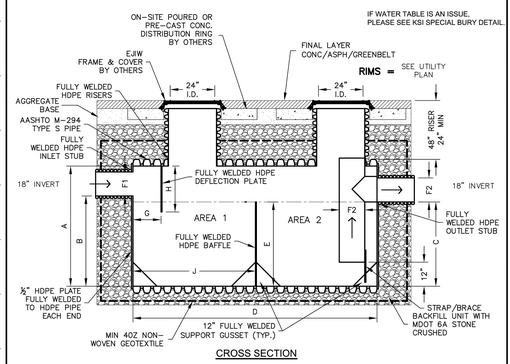
STORM WATER TREATMENT CHAMBER

KSI SERIES 1250 HDPE CHAMBER

NOTE:
INSTALL UNIT PER ASTM D2321

4 OZ NON-WOVEN GEOTEXTILE FABRIC WRAP REQUIRED SEE TRENCH DETAIL

IF WATER TABLE IS AN ISSUE, PLEASE SEE KSI SPECIAL BURY DETAIL



CROSS SECTION

STORM WATER TREATMENT CHAMBER DIMENSIONS AND CAPACITIES

MODEL NO.	A	B	C	D	E	F1	F2	G	H	J	AREA 1	AREA 2
1250-48-12	48"	33"	32"	165"	32"	12"	12"	12"	20"	83"	61.1 CF	149 CF

DESIGN BY: AG / RK	REV: 10-21-22 DATE: 10-10-08	2 OF 2	KSI KENNEDY SOLUTIONS, INC. 10051 Bergin Road Howell, MI 48843 Ph: 800-699-4046
MANUF. APPROVAL BY: .	SCALE: NTS	SHEET NO.	
DRAWING NO. SERIES 1250 SWTC v2022			

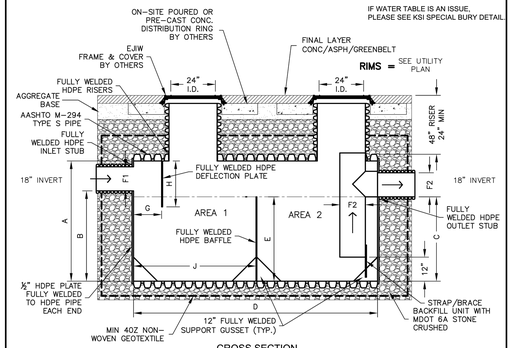
STORM WATER TREATMENT CHAMBER

KSI SERIES 1750 HDPE CHAMBER

NOTE:
INSTALL UNIT PER ASTM D2321

4 OZ NON-WOVEN GEOTEXTILE FABRIC WRAP REQUIRED SEE TRENCH DETAIL

IF WATER TABLE IS AN ISSUE, PLEASE SEE KSI SPECIAL BURY DETAIL

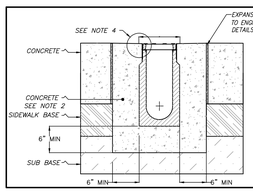


CROSS SECTION

STORM WATER TREATMENT CHAMBER DIMENSIONS AND CAPACITIES

MODEL NO.	A	B	C	D	E	F1	F2	G	H	J	AREA 1	AREA 2
1750-60-15	60"	42"	41"	165"	41"	15"	15"	15"	21"	83"	97.9 CF	140 CF

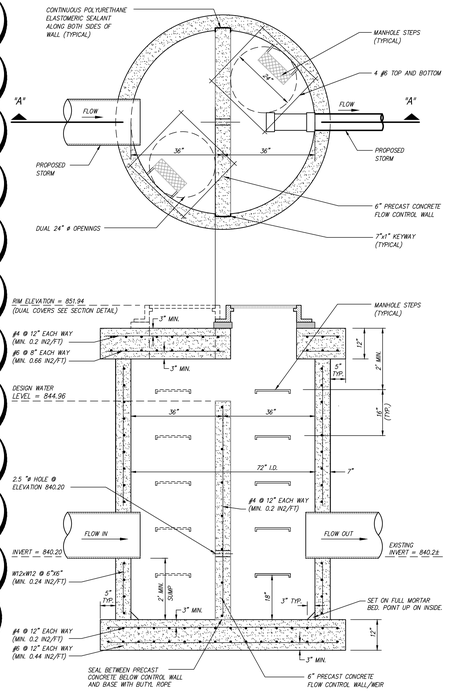
DESIGN BY: AG / RK	REV: 10-21-22 DATE: 10-10-08	2 OF 2	KSI KENNEDY SOLUTIONS, INC. 10051 Bergin Road Howell, MI 48843 Ph: 800-699-4046
MANUF. APPROVAL BY: .	SCALE: NTS	SHEET NO.	
DRAWING NO. SERIES 1750 SWTC v2022			



NOTES:
MODEL NUMBER KS100S SLOPED CHANNEL WITH TYPE 4650 GRATE LOAD CLASS C.
1. IT IS NECESSARY TO ENSURE THE MINIMUM DIMENSIONS SHOWN ARE SUITABLE FOR THE EXISTING GROUND CONDITIONS. ENGINEERING ADVICE MAY BE REQUIRED.
2. A MINIMUM CONCRETE STRENGTH OF 3000 PSI IS RECOMMENDED. THE CONCRETE SHOULD BE VIBRATED TO ELIMINATE AIR POCKETS.
3. THE FINISHED LEVEL OF THE CONCRETE SURROUND MUST BE APPROX. 1/4" ABOVE THE TOP OF THE CHANNEL EDGE.
4. REFER TO ACO'S LATEST INSTALLATION INSTRUCTIONS FOR COMPLETE DETAILS.

ACO TRENCH DRAIN KS100S DETAIL

NOT TO SCALE

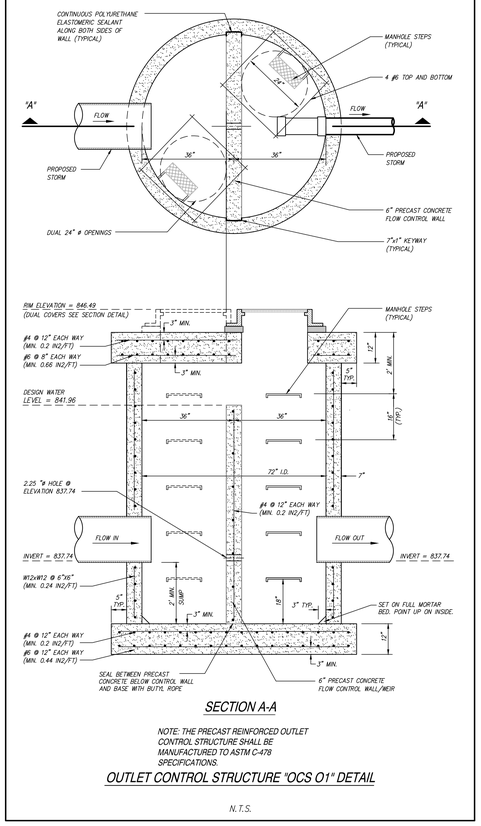


SECTION A-A

NOTE: THE PRECAST REINFORCED OUTLET CONTROL STRUCTURE SHALL BE MANUFACTURED TO ASTM C-478 SPECIFICATIONS.

OUTLET CONTROL STRUCTURE "OCS O2" DETAIL

N.T.S.



SECTION A-A

NOTE: THE PRECAST REINFORCED OUTLET CONTROL STRUCTURE SHALL BE MANUFACTURED TO ASTM C-478 SPECIFICATIONS.

OUTLET CONTROL STRUCTURE "OCS O1" DETAIL

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ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
ADDENDUM #3	03.15.2024

KEY PLAN

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JOB NO. 2616.01A

SHEET TITLE

UTILITY DETAIL

SHEET NO.

C6.2

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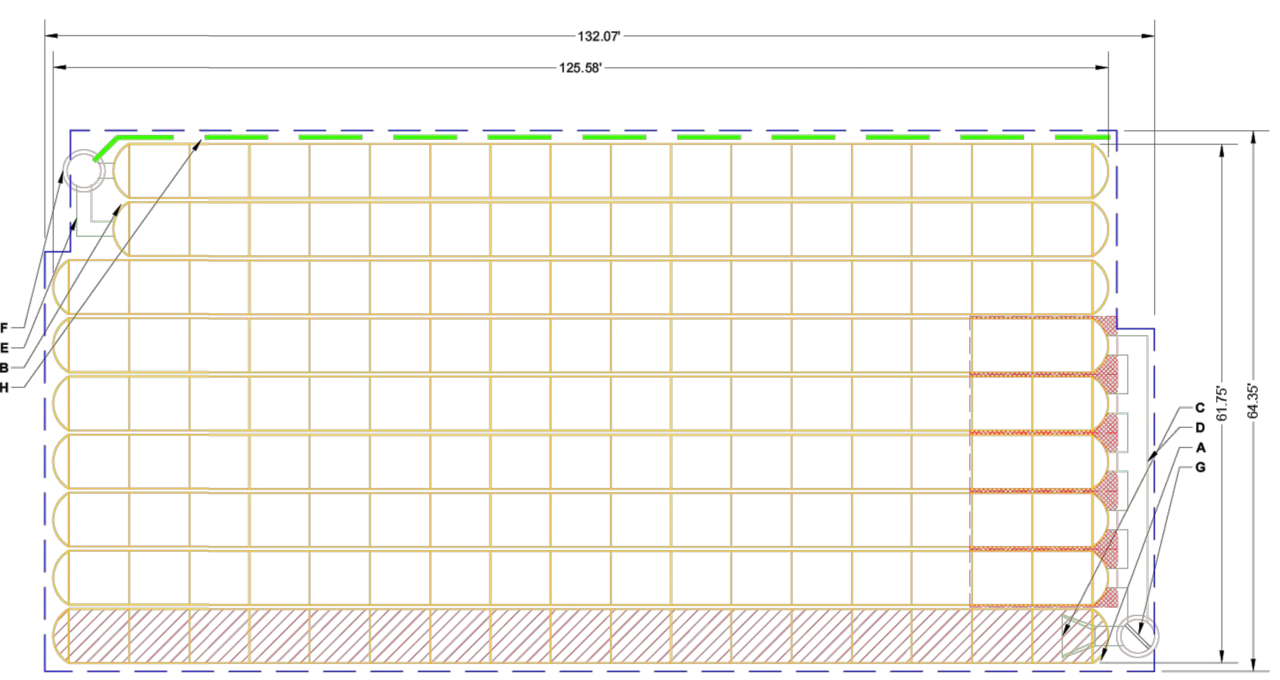
PROPOSED LAYOUT	
151	STORMTECH MC-3500 CHAMBERS
18	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
28491	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
8349	SYSTEM AREA (SF)
392.8	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
TOP OF STONE:	5.50
TOP OF MC-3500 CHAMBER:	4.50
24" x 24" BOTTOM MANIFOLD INVERT:	0.92
24" ISOLATOR ROW PLUS INVERT:	0.92
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" BOTTOM CONNECTION INVERT:	0.90
BOTTOM OF MC-3500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.06"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		35.8 CFS IN
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

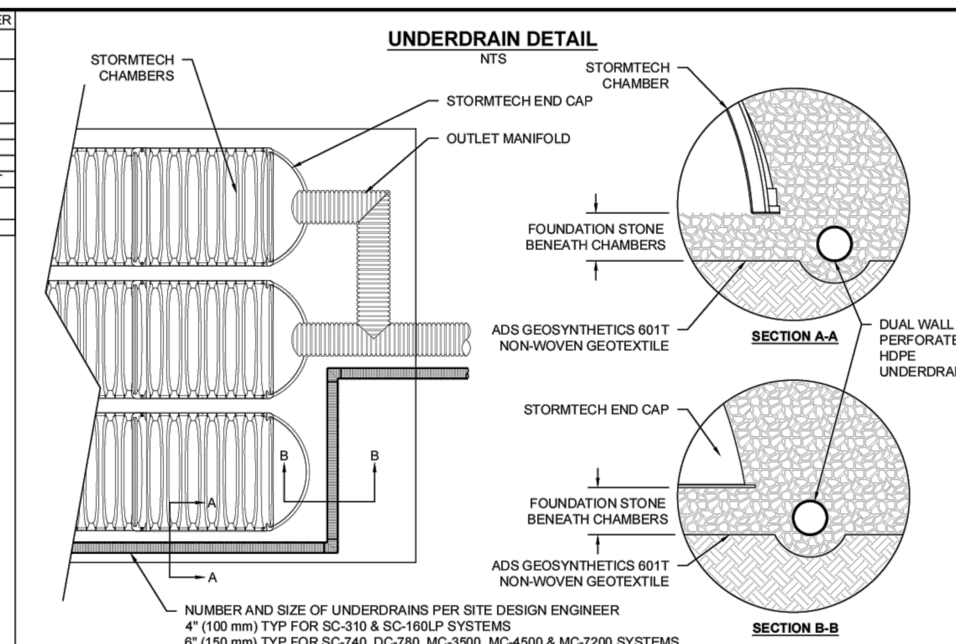
BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

UNDERDRAIN DETAIL

NTS

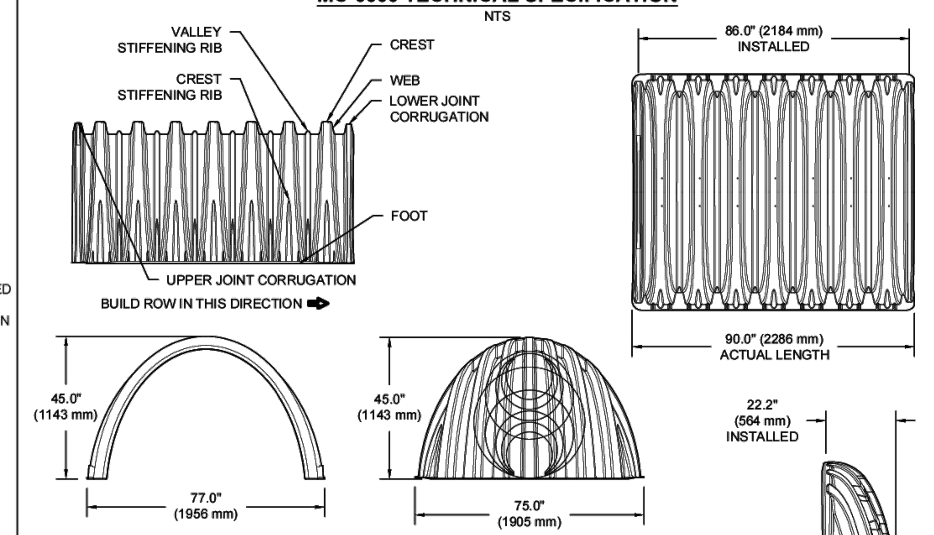


4 UNDERDRAIN DETAIL

SPACE INTENTIONALLY LEFT BLANK

MC-3500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

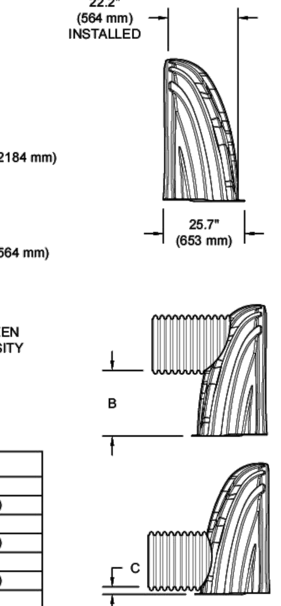
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

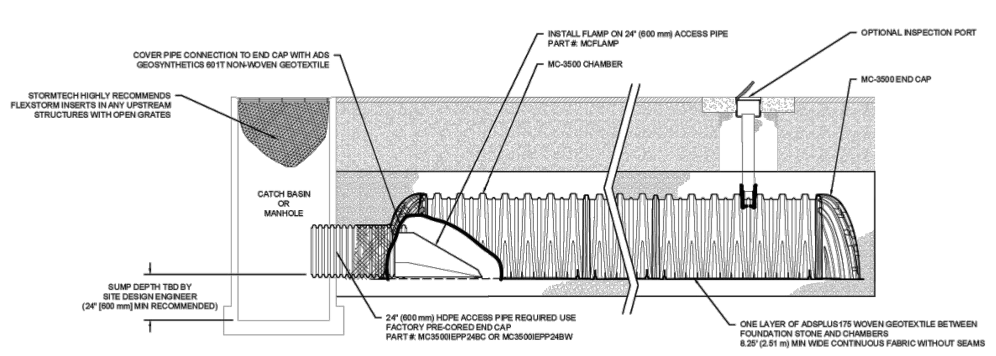
PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

2 MC-3500 TECHNICAL SPECIFICATION



MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

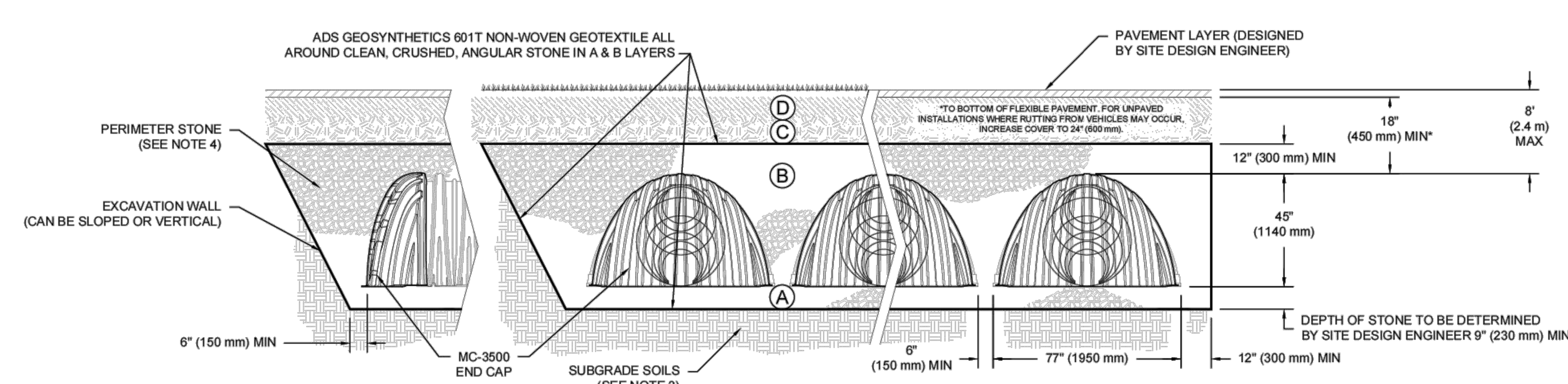
1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

3 MC-3500 ISOLATOR ROW PLUS DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1 MC-3500 CROSS SECTION DETAIL

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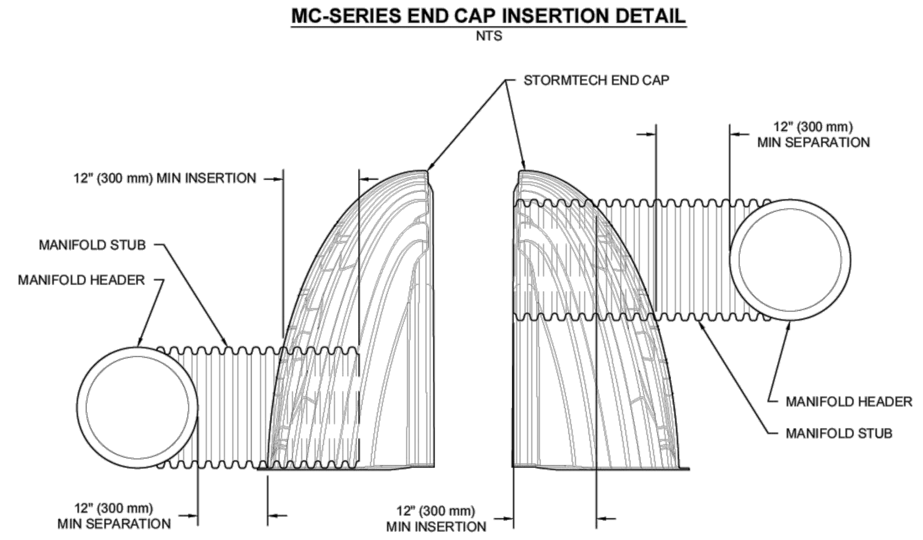
MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

5 MC-SERIES END CAP INSERTION DETAIL

WILLOW NORTH
LANSING, MI, USA

DRAWN: CD
CHECKED: N/A
DATE:
PROJECT #:
REV:
NOT TO SCALE

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

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SHEET
1 OF 1

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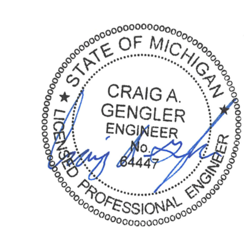
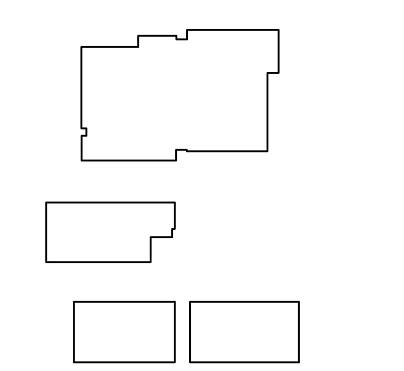


Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024



KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

UTILITY DETAIL

SHEET NO.

C6.3

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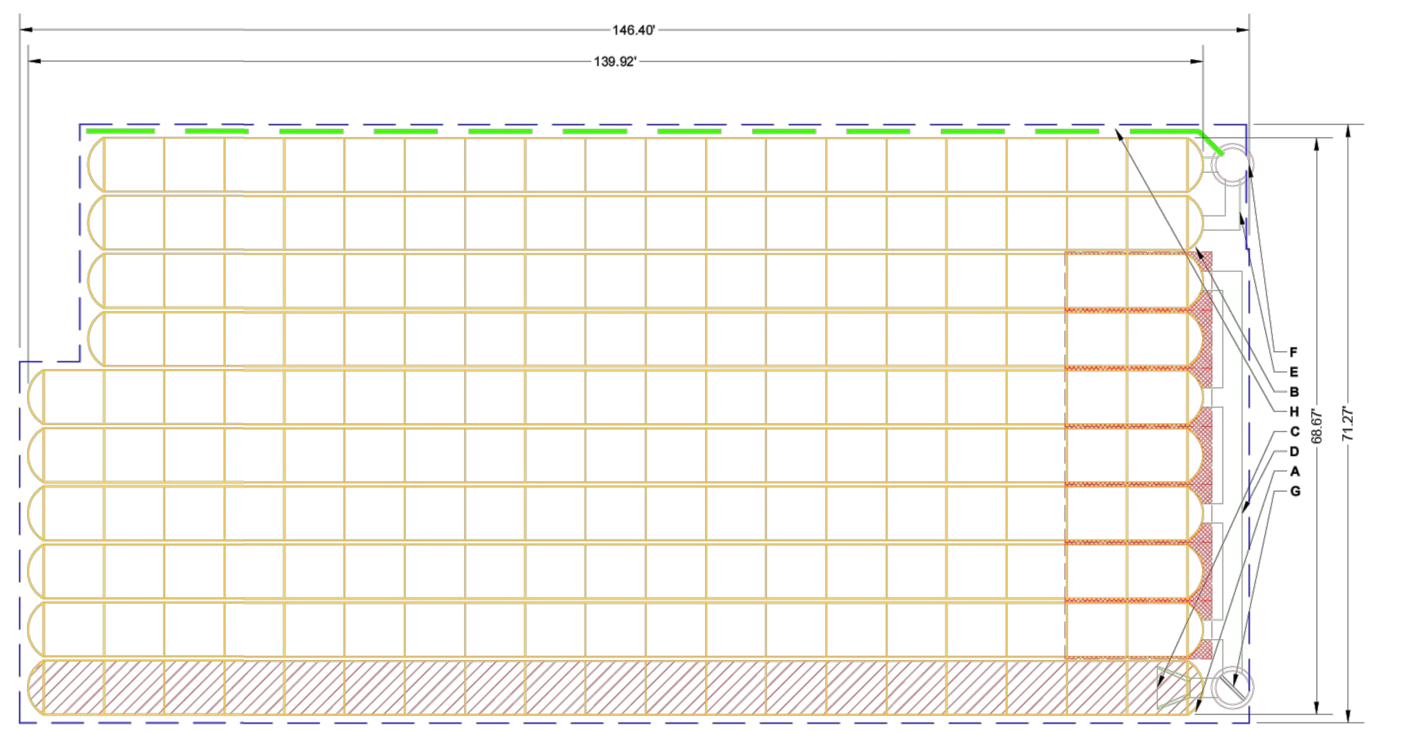
LAST PRINTED:

PROPOSED LAYOUT	
186	STORMTECH MC-3500 CHAMBERS
20	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
34946	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
10226	SYSTEM AREA (SF)
435.3	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
TOP OF STONE:	5.50
TOP OF MC-3500 CHAMBER:	4.50
24" x 24" BOTTOM MANIFOLD INVERT:	0.92
24" ISOLATOR ROW PLUS INVERT:	0.92
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" BOTTOM CONNECTION INVERT:	0.90
BOTTOM OF MC-3500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.06"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		34.0 CFS IN
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



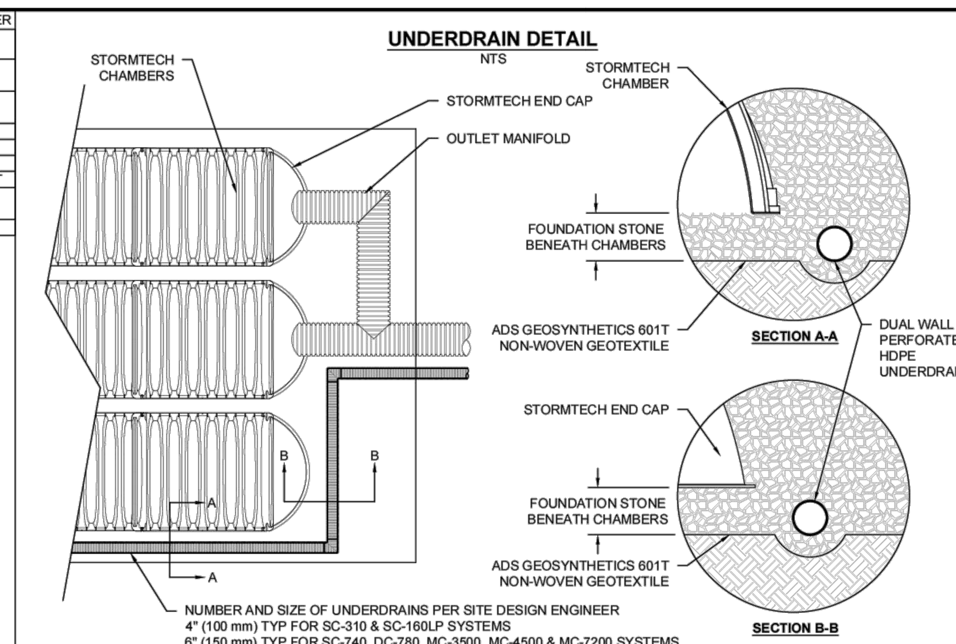
ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

UNDERDRAIN DETAIL
NTS



4 UNDERDRAIN DETAIL

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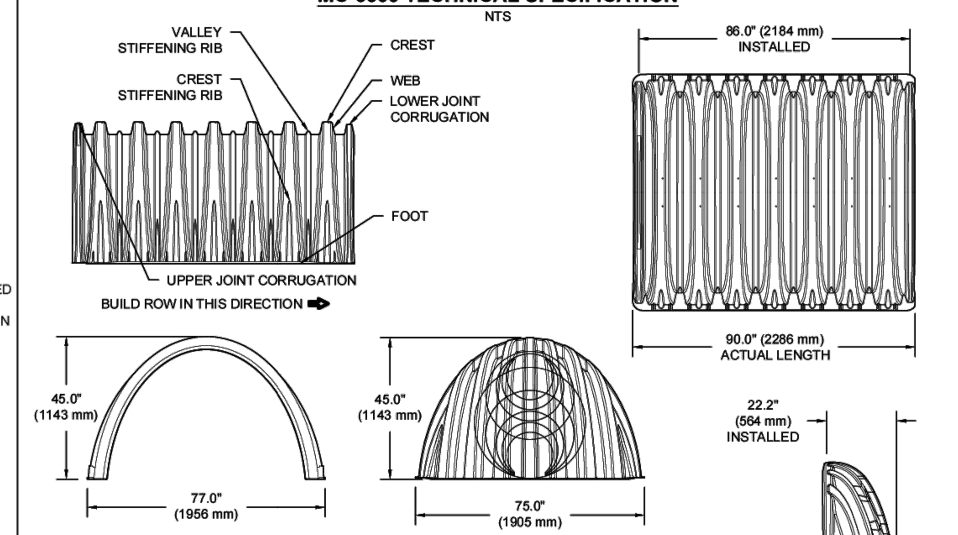
MC-3500 TECHNICAL SPECIFICATION
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

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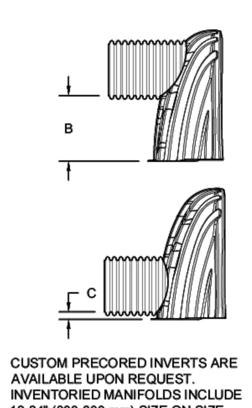

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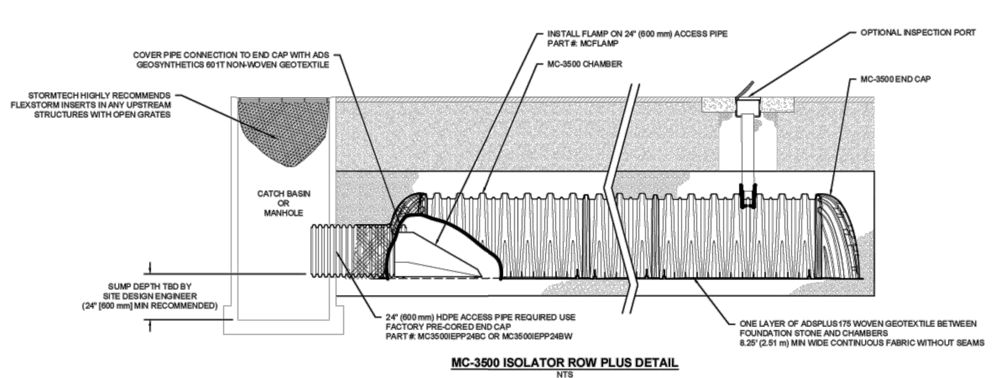

MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

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- A. INSPECTION PORTS (IF PRESENT)
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  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
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    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
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- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES
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2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

3 MC-3500 ISOLATOR ROW PLUS DETAIL

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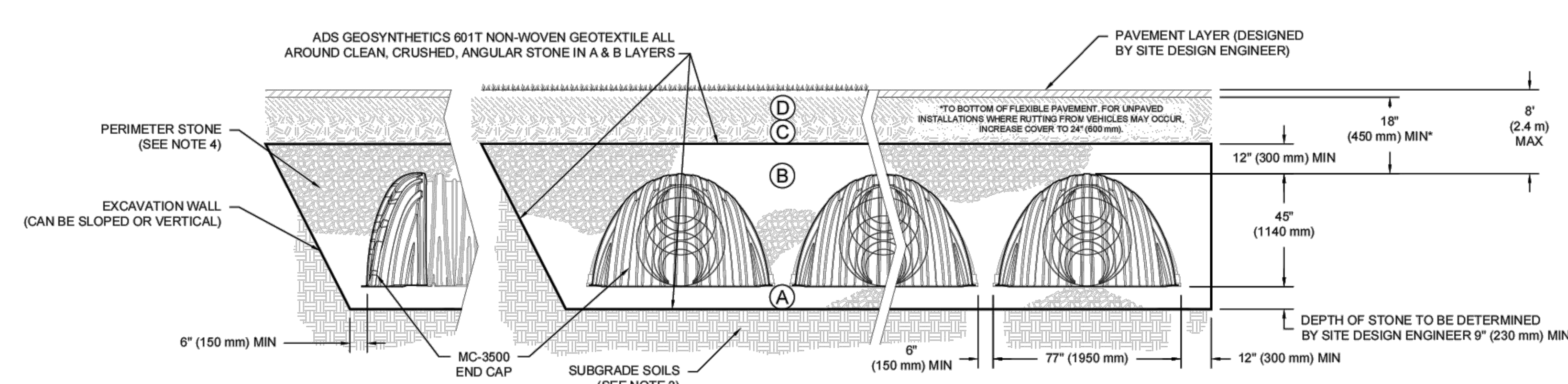
	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

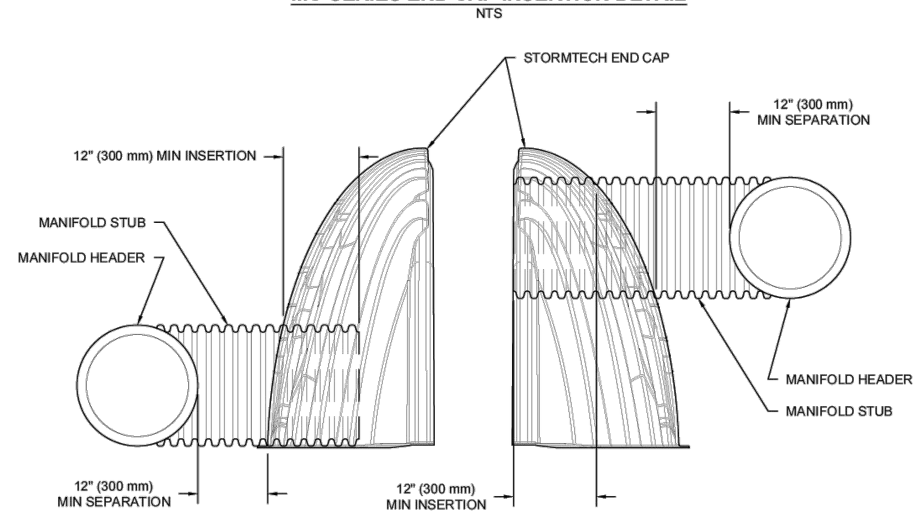


NOTES:
1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1 MC-3500 CROSS SECTION DETAIL

SPACE INTENTIONALLY LEFT BLANK

MC-SERIES END CAP INSERTION DETAIL
NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

5 MC-SERIES END CAP INSERTION DETAIL

DRAWN: CD | CHECKED: N/A | REV:
DATE: | PROJECT #: | NOT TO SCALE

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LANSING, MI, USA

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SHEET 1 OF 1

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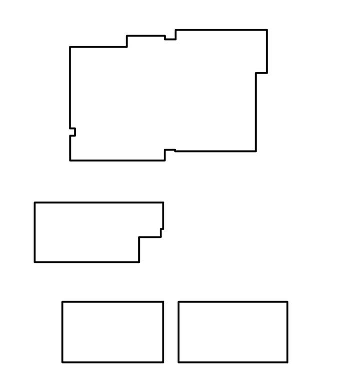
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
CRAIG A. GENGLER
ENGINEER
No. 44447
LICENSED PROFESSIONAL ENGINEER

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024



KEY PLAN
N

JOB NO. 2616.01A
SHEET TITLE
UTILITY DETAIL
SHEET NO.
C6.4

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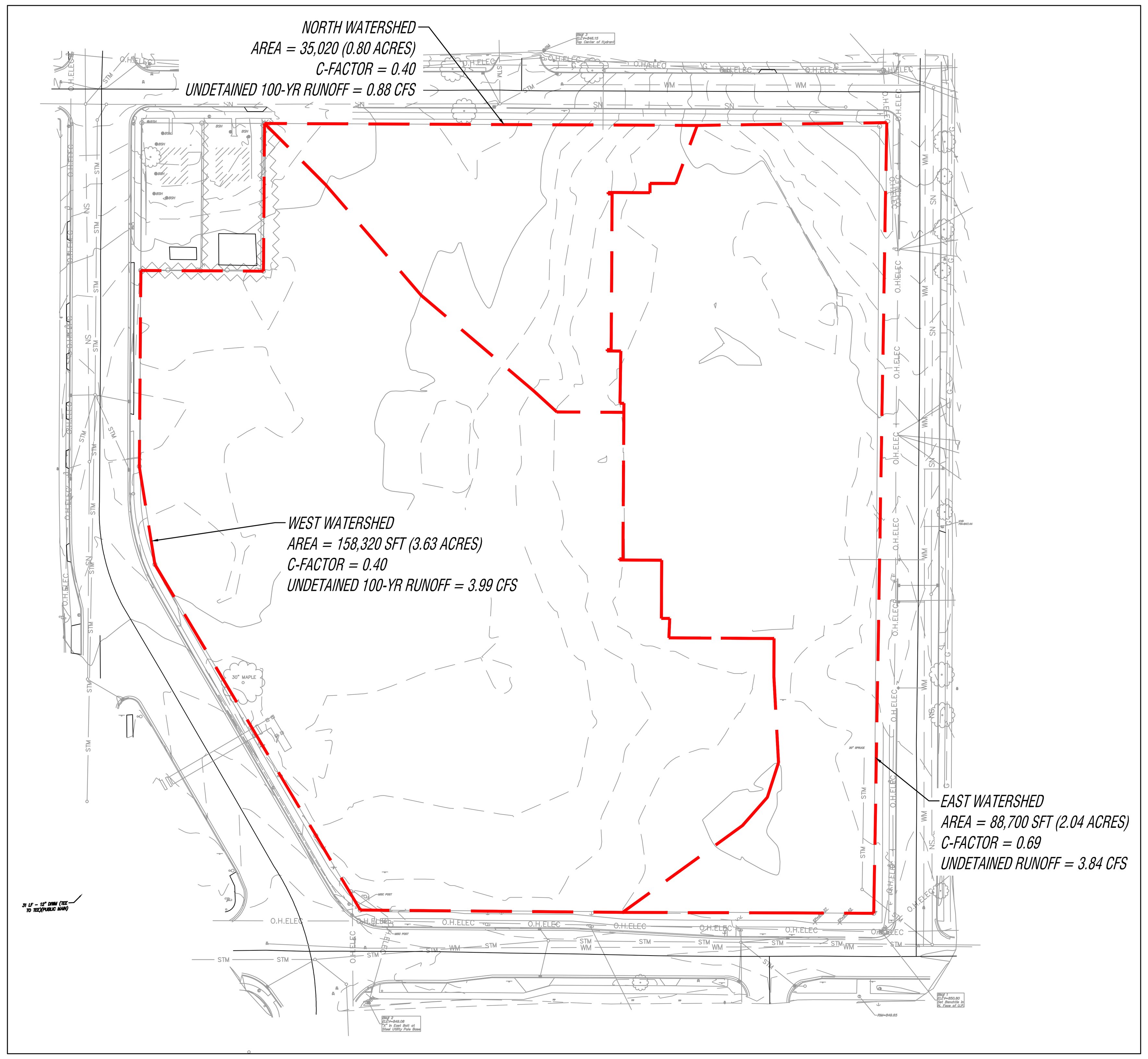
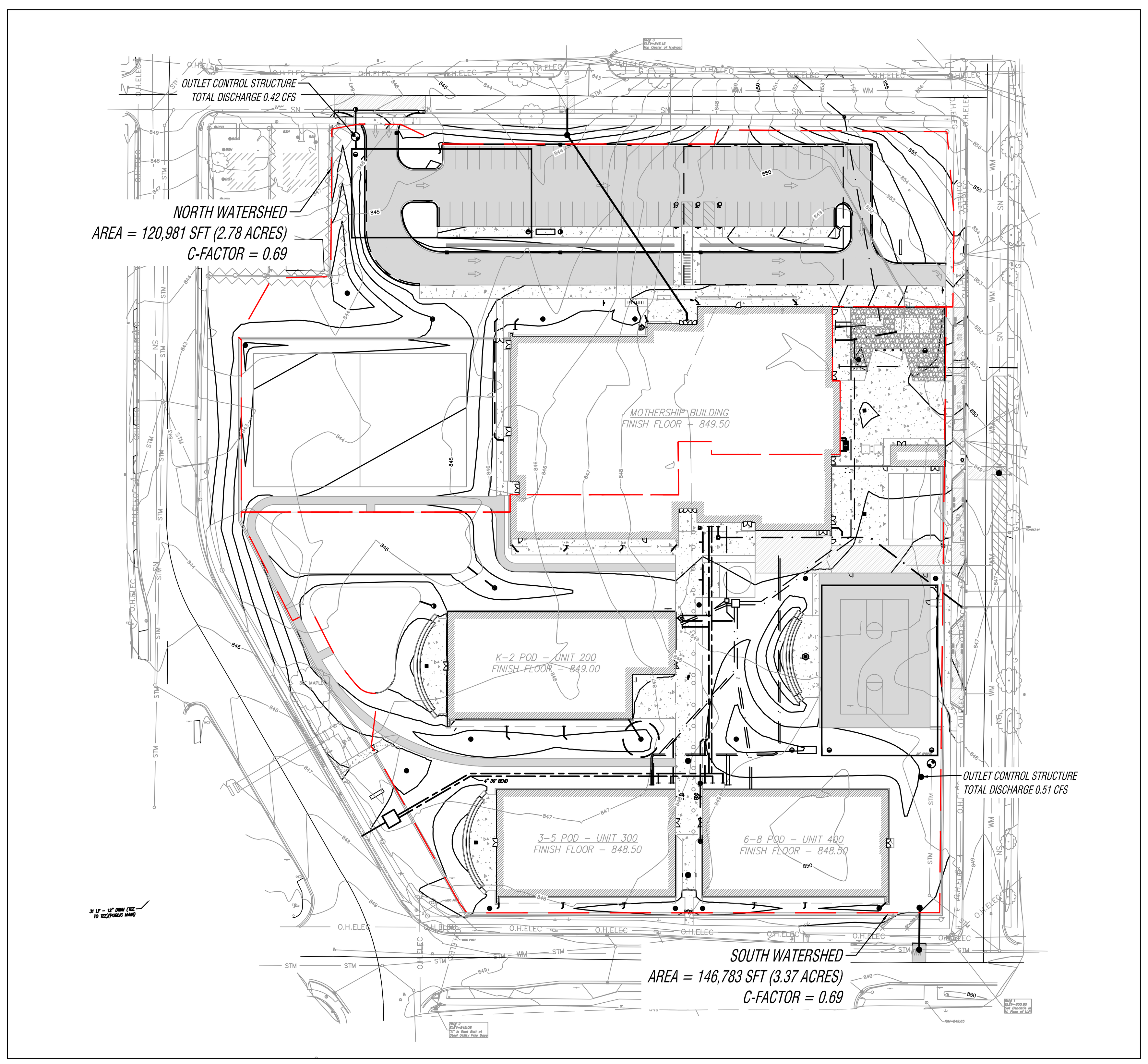


EXISTING CONDITIONS DELINEATION



PROPOSED CONDITIONS DELINEATION

PROJECT SUMMARY:

EXISTING CONDITIONS:

THE EXISTING 6.236-ACRE SITE CONSISTS OF AN EXISTING SCHOOL BUILDING AND ACCOMPANYING ASPHALT PARKING LOTS. EXISTING STORMWATER RUNOFF IS NOT DETAINED AND SHEET FLOWS ACROSS THE PROPERTY TO THE COMBINED SEWER SYSTEM WITHIN THE SURROUNDING STREETS. THE RUNOFF HAS BEEN DELINEATED INTO THREE WATERSHEDS, THE WEST WATERSHED SHEET FLOWS UNDETAINED WEST INTO N MARTIN LUTHER KING JR. BLVD. ROW SEWER, THEN INTO THE COMBINED SEWER SYSTEM WITHIN ONTARIO ST. THE NORTH WATERSHED SHEET FLOWS ACROSS THE SITE NORTH TO THE ONTARIO ST. ROW. THE EAST WATERSHED INCLUDES THE EXISTING BUILDING AND THE EAST PORTION OF THE SITE, THE RUNOFF IS COLLECTED BY A STORM SEWER THAT RUNS ON-SITE TO THE SOUTH AND DISCHARGES INTO THE COMBINED SEWER WITHIN W WILLOW ST. THE NORTH AND WEST WATERSHED OVERALL 100-YR STORM RUNOFF INTO THE ONTARIO ST. SEWER IS 4.87 CFS (3.99 WEST WATERSHED, 0.88 NORTH WATERSHED). THE EAST WATERSHED 100-YR STORM RUNOFF IS 3.84 CFS INTO W WILLOW ST SEWER.

THE EXISTING IMPERVIOUS SURFACE AREA IS 66,436 SFT (1.52-ACRE) FOR AN EXISTING C-FACTOR OF 0.50. THE EXISTING STRUCTURES AND PAVEMENT ARE BEING DEMOLISHED AND REMOVED COMPLETELY.

PROPOSED IMPROVEMENTS:

THE PROPOSED IMPROVEMENTS INCLUDE THE CONSTRUCTION OF ONE (1) MAIN SCHOOL BUILDING, 37,514 SFT, AND THREE (3) CLASSROOM POD BUILDINGS, 12,117 SFT, 10,262 SFT, AND 10,633 SFT RESPECTIVELY. THE REMAINING SITE IMPROVEMENTS INCLUDE THREE (3) AMPHITHEATERS, TWO (2) PLAYGROUNDS, PLAY FIELD AND ACCOMPANYING PARKING LOTS AND PAVEMENTS. THE PROPOSED IMPERVIOUS SURFACE AREA IS 148,376 SFT (3.41 ACRES) WITH A C-FACTOR OF 0.68. PER THE STORMWATER REQUIREMENTS THE OVERALL SITE RELEASE RATE IS 0.94 CFS (0.15 CFS/ACRE).

THE SITE STORMWATER IS PROPOSED TO DIVIDE THE SITE INTO TWO (2) WATERSHEDS, NORTH AND SOUTH RESPECTIVELY. BOTH STORM WATERSHEDS ARE PROPOSED TO BE TREATED BY PRETREATMENT STRUCTURES, AND UNDERGROUND STORMWATER DETENTION BASINS. THE RUNOFF FOR BOTH BASINS WILL GO THROUGH PRETREATMENT SYSTEMS PRIOR SIZED FOR 80% TSS REMOVAL FOR THE 10-YR STORM EVENT.

THE NORTH WATERSHED TREATS 120,981 SFT (2.78-ACRE) WITH AN OVERALL WEIGHTED C-FACTOR OF 0.69. THE REQUIRED STORAGE VOLUME FOR THE 100-YR STORM IS 22,246 CFT, WITH A SAFETY FACTOR OF 1.25 THE TOTAL STORAGE REQUIRED IS 27,808 CFT WITH A RELEASE RATE OF 0.42 CFS. THE TIME TO EMPTY FOR THE SYSTEM IS 19 HOURS. THE PROPOSED UNDERGROUND DETENTION BASIN CAPACITY IS 28,486 CFT. THIS IS A REDUCTION OF 4.45 CFS INTO THE ONTARIO ST SEWER DURING THE 100-YR STORM EVENT.

THE SOUTH WATERSHED TREATS 146,783 SFT (3.37-ACRE) WITH AN OVERALL WEIGHTED C-FACTOR OF 0.69. THE REQUIRED STORAGE VOLUME FOR THE 100-YR STORM IS 27,189 CFT, WITH A SAFETY FACTOR OF 1.25 APPLIED THE TOTAL STORAGE REQUIRED IS 33,986 CFT WITH A RELEASE RATE OF 0.51 CFS. THE TIME TO EMPTY FOR THE SYSTEM IS 19 HOURS. THE PROPOSED UNDERGROUND DETENTION BASIN CAPACITY IS 34,898 CFT. THIS IS A REDUCTION OF 3.33 CFS INTO THE W WILLOW ST SEWER DURING THE 100-YR STORM EVENT.

GRAPHIC SCALE 0 30 60 120 (IN FEET) 1 inch = 60 ft.

LEGEND

Symbol	Description	Symbol	Description
	PROPOSED WATERMAIN		PROPOSED SAN MANHOLE (SAN)
	PROPOSED SANITARY		PROPOSED STORM MANHOLE (MH)
	PROPOSED STORM SEWER		PROPOSED CATCH BASIN (CB)
	PROPOSED GAS MAIN		PROPOSED INLET (INL)
	PROPOSED ELECTRIC		PROPOSED END SECTION (ES)
	PROPOSED HYDRANT		PROPOSED FIELD CATCH BASIN (FCB) W/BEEHIVE COVER OR STANDPIPE (SP) W/ BAR GRATE COVER
	PROPOSED GATE VALVE & WELL (GVW)		
	PROPOSED TAPPING SLEEVE, VALVE & WELL (TSVW)		
	STANDARD BITUMINOUS PAVEMENT	(2)	UTILITY CROSSING (SEE DATA TABLE)
	HEAVY-DUTY BITUMINOUS PAVEMENT	STORM SEWER STRUCTURE	CB- STRUCT. TYPE; 2 STRUCT. NO.
	DEEP-STRENGTH BITUMINOUS PAVEMENT	SANITARY SEWER STRUCTURE	(20)
	CONCRETE PAVEMENT		
	CONCRETE SIDEWALK	WATERMAIN STRUCTURE	10 STRUCT. NO.; XXX STRUCT. TYPE
	MILL PAVEMENT		

Overall Site C Factor Calculations

Project:	Willow Elementary School
County:	Ingham
Location:	1012 W Willow St., Lansing, MI
Duration:	100-Year

C Factor Existing Conditions

Surface	C-Value	Area (sft)
Impervious Surface	0.95	66,436
Lawn or Open Space (HSG C)	0.35	201,328
	Total Area (sft)	**267,764**
	Total Area (acre)	**6.15**
	Overall Weighted C-Factor	**0.50**
	Impervious %	**25%**

C Factor Proposed Conditions

Surface	C-Value	Area (sft)
Impervious Surface	0.95	148,376
Brick and Gravel	0.85	3,058
Lawn or Open Space (HSG C)	0.35	116,331
	Total Area (sft)	**267,764**
	Total Area (acre)	**6.15**
	Overall Weighted C-Factor	**0.69**
	Impervious %	**55%**

Existing West Watershed C Factor

Surface	C-Value	Area (sft)
Impervious Surface	0.95	13,668
Lawn or Open Space (HSG C)	0.35	144,652
	Total Area (sft)	**158,320**
	Total Area (acre)	**3.63**
	Overall Weighted C-Factor	**0.40**
	Impervious %	**9%**

10-yr Stormwater Runoff

Q = CIA

C =	0.40
$I_{100\text{-yr}}$ =	2.73 In/hr
A =	3.63 Acres
Q_{100} =	**3.99 cfs**

Existing East Watershed C Factor

Surface	C-Value	Area (sft)
Impervious Surface	0.95	50,336
Lawn or Open Space (HSG C)	0.35	38,364
	Total Area (sft)	**88,700**
	Total Area (acre)	**2.04**
	Overall Weighted C-Factor	**0.69**
	Impervious %	**57%**

10-yr Stormwater Runoff

Q = CIA

C =	0.69
$I_{1\text{-hr}}$ =	2.73 In/hr
A =	2.04 Acres
Q_{100} =	**3.84 cfs**

Existing North Watershed C Factor

Surface	C-Value	Area (sft)
Impervious Surface	0.95	3,024
Lawn or Open Space (HSG C)	0.35	31,997
	Total Area (sft)	**35,020**
	Total Area (acre)	**0.80**
	Overall Weighted C-Factor	**0.40**
	Impervious %	**9%**

10-yr Stormwater Runoff

Q = CIA

C =	0.40
$I_{1\text{-hr}}$ =	2.73 In/hr
A =	0.80 Acres
Q_{100} =	**0.88 cfs**

Proposed Conditions North Watershed Detention Basin Sizing

Project:	Willow Elementary School
County:	Ingham
Location:	1012 W Willow St., Lansing, MI
Duration:	100-Year

C Factor

Surface	C-Value	Area (sft)
Impervious Surface	0.95	67,728
Lawn or Open Space (HSG C)	0.35	53,254
	Total Area (sft)	**120,981**
	Total Area (acre)	**2.78**
	Overall Weighted C-Factor	**0.69**
	Impervious %	**56%**

Allowable Discharge (cfs)	
Total Acres	**2.78 acre**
Release Rate	**0.15 cfs/acre**
Total Discharge	**0.42 cfs**

Rational Method Detention Basin Routing

Time (hr)	Rainfall Intensity (in/hr)	Runoff Discharge (cfs)	Runoff Volume (cft)	Discharge Volume (cft)	Storage Volume (cft)
0.08	9.40	17.90	5,370	125	5,245
0.17	6.90	13.14	7,887	250	7,637
0.25	5.60	10.67	9,601	375	9,226
0.50	4.02	7.66	13,784	750	13,034
1.00	2.73	5.20	18,722	1,500	17,222
2.00	1.72	3.28	23,591	3,000	20,591
3.00	1.30	2.48	26,746	4,499	***22,246***
4.00	1.03	1.96	28,163	5,999	22,164
5.00	0.86	1.64	29,580	7,499	22,081
6.00	0.75	1.44	30,997	8,999	21,999
8.00	0.50	0.95	27,340	11,998	15,342
12.00	0.24	0.46	20,025	17,997	2,028
18.00	0.23	0.44	28,734	26,996	1,739
24.00	0.23	0.43	37,444	35,994	1,449
				Total Storage Required (cft) =	22,246
				Total Storage w/ 1.25 Safety Factor =	27,808
				Time to Empty (hrs) =	19

Cumulative Storage Elevation

Storage Elevation	Cumul. Vol. (cft)
842.00	27,934
841.92	27,656
Elevation Below (ft):	841.92
Elevation Above (ft):	842.00
Flood Control Elevation (ft):	841.96

*From Stormtech Cumulative Storage Volume Spreadsheet

Outlet Control Structure

Orifice Sizing

$Q = C_d A_0 \sqrt{2gh}$

C_d =	0.98
Orifice Dia =	2.25 in
A_0 =	0.028 ft^2
g =	32.2 ft^2/s
Elev of Overflow Weir =	841.96 ft
Invert of Orifice =	837.74 ft
h =	4.22 ft
Q =	**0.45 cfs**

Emergency Overflow Weir

Emergency Overflow 100-yr Storm

Q = CIA

C =	0.69
$I_{24\text{-hr}}$ =	2.73 In/hr
A =	2.78 Acres
Q_{100} =	**5.20 cfs**

Overflow Weir Sizing

$Q = CLH^{3/2}$

C =	3.33
L =	6.0 ft
Elev of System Overland Overflow =	843.00 ft
Elev of Overflow Weir =	841.96 ft
H =	1.04 ft
Q =	**21.31 cfs**

Proposed Conditions South Watershed Detention Basin Sizing

Project:	Willow Elementary School
County:	Ingham
Location:	1012 W Willow St., Lansing, MI
Duration:	100-Year

C Factor

Surface	C-Value	Area (sft)
Impervious Surface	0.95	80,648
Gravel and Brick	0.85	3,058
Lawn or Open Space (HSG C)	0.35	63,077
	Total Area (sft)	**146,783**
	Total Area (acre)	**3.37**
	Overall Weighted C-Factor	**0.69**
	Impervious %	**55%**

Allowable Discharge (cfs)	
Total Acres	**3.37 acre**
Release Rate	**0.15 cfs/acre**
Total Discharge	**0.51 cfs**

Rational Method Detention Basin Routing

Time (hr)	Rainfall Intensity (in/hr)	Runoff Discharge (cfs)	Runoff Volume (cft)	Discharge Volume (cft)	Storage Volume (cft)
0.08	9.40	21.85	6,555	152	6,403
0.17	6.90	16.04	9,627	303	9,324
0.25	5.60	13.02	11,720	455	11,265
0.50	4.02	9.35	16,826	910	15,916
1.00	2.73	6.35	22,853	1,820	21,034
2.00	1.72	4.00	28,797	3,639	25,158
3.00	1.30	3.02	32,648	5,459	***27,189***
4.00	1.03	2.39	34,378	7,278	27,099
5.00	0.86	2.01	36,108	9,098	27,010
6.00	0.75	1.75	37,838	10,918	26,920
8.00	0.50	1.16	33,373	14,557	18,816
12.00	0.24	0.57	24,444	21,835	2,608
18.00	0.23	0.54	35,075	32,753	2,322
24.00	0.23	0.53	45,707	43,671	2,036
				Total Storage Required (cft) =	27,189
				Total Storage w/ 1.25 Safety Factor =	33,986
				Time to Empty (hrs) =	19

Cumulative Storage Elevation

Storage Elevation	Cumul. Vol. (cft)
844.98	34,222
844.90	33,881
Elevation Below (ft):	844.90
Elevation Above (ft):	844.98
Flood Control Elevation (ft):	844.96

*From Stormtech Cumulative Storage Volume Spreadsheet

Outlet Control Structure

Orifice Sizing

$Q = C_d A_0 \sqrt{2gh}$

C_d =	0.98
Orifice Dia =	2.5 in
A_0 =	0.034 ft^2
g =	32.2 ft^2/s
Elev of Overflow Weir =	844.96 ft
Invert of Orifice =	840.20 ft
h =	4.76 ft
Q =	**0.58 cfs**

Emergency Overflow Weir

Emergency Overflow 100-yr Storm

Q = CIA

C =	0.69
$I_{24\text{-hr}}$ =	2.73 In/hr
A =	3.37 Acres
Q_{100} =	**6.35 cfs**

Emergency Overflow Internal Weir

$Q = CLH^{3/2}$

C =	3.33
L =	6.0 ft
Elev of System Overland Overflow =	847.15 ft
Elev of Overflow Weir =	844.96 ft
H =	2.19 ft
Q =	**64.96 cfs**

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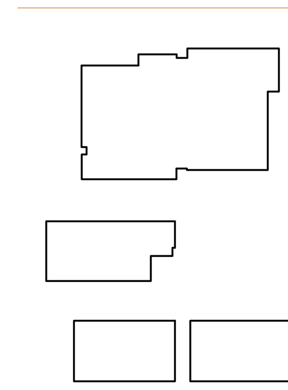
Lansing, MI 48915

STATE OF MICHIGAN — CRAIG A. GENGLER — ENGINEER — No. 64447 — LICENSED PROFESSIONAL ENGINEER

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024



KEY PLAN

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JOB NO. 2616.01A

SHEET TITLE

DRAINAGE AREA MAP

SHEET NO.

C7.1

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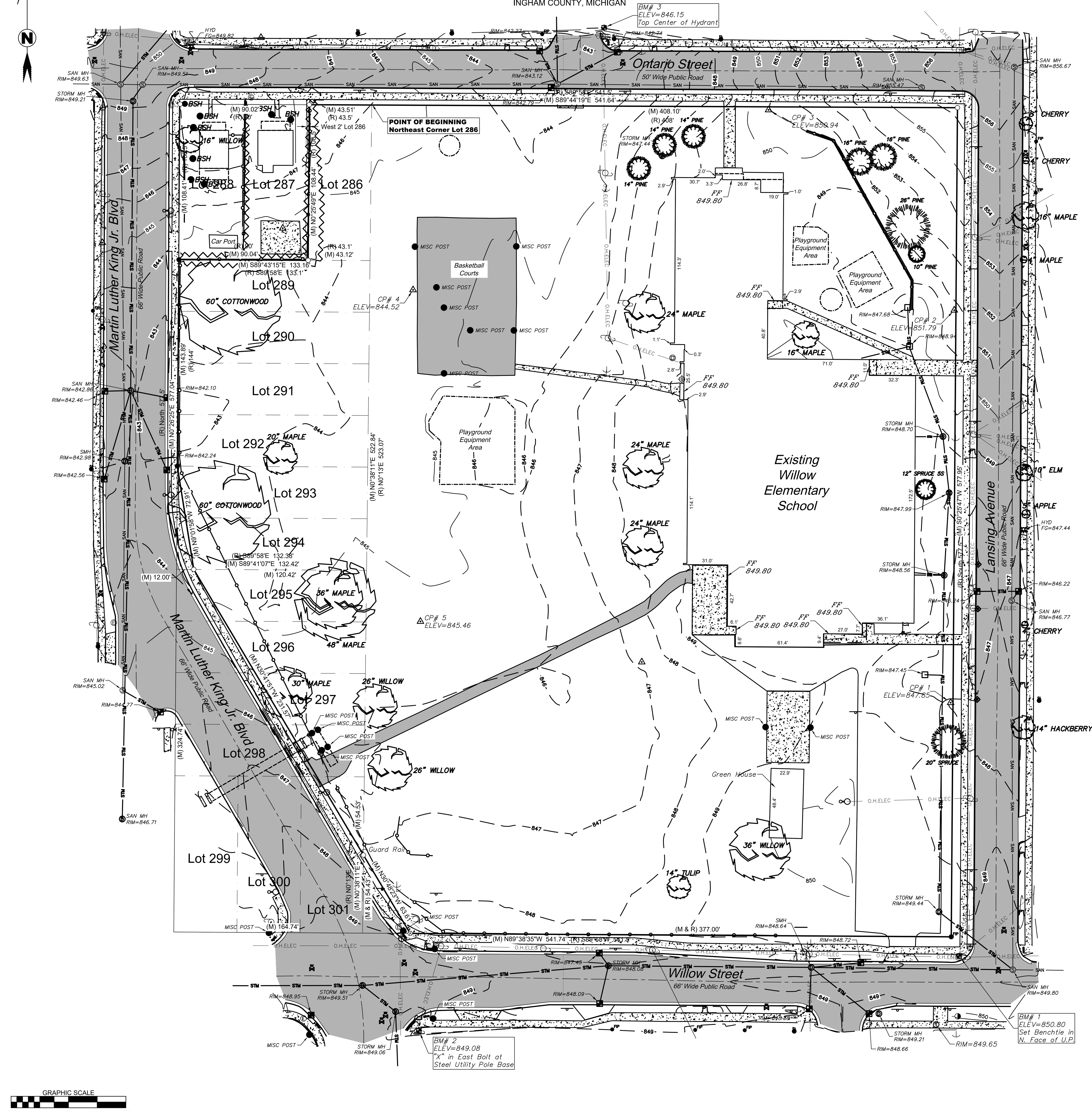
SECTION 8, T4N, R2W, CITY OF LANSING
INGHAM COUNTY, MICHIGAN

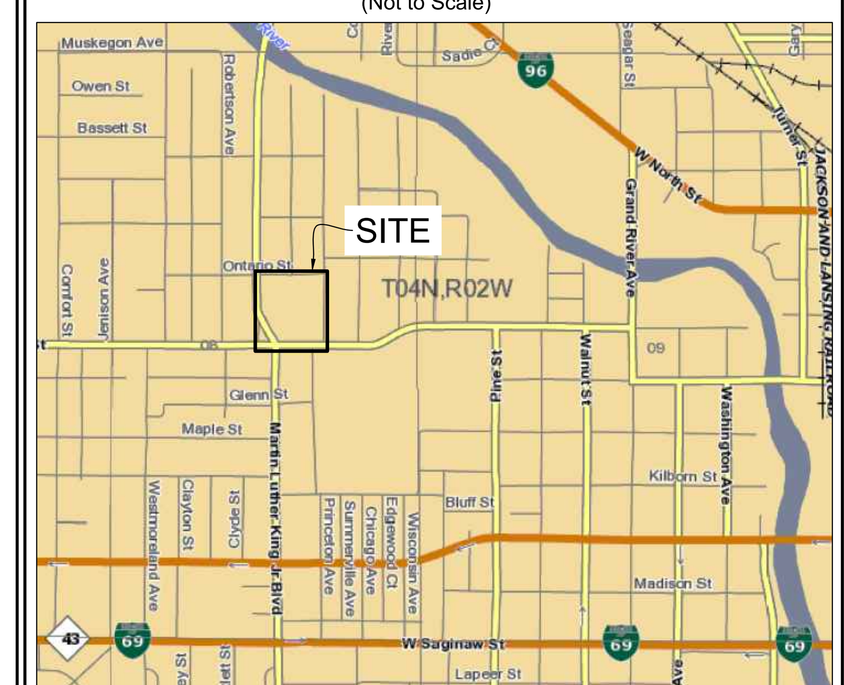


LEGEND

SQUARE CATCH BASIN		FOUND CAPPED IRON	
LIGHT POLE		FOUND CONCRETE MONUMENT	
TELE PEDESTAL		SET CAPPED IRON	
UTILITY POLE		FOUND IRON OR PIPE	
SIGN		SECTION CORNER	
TEST PIT		BENCHMARK	
GAS METER			
ELEC TRANSFORMER		MISS DIG – WATER	
WATER VALVE		MISS DIG – ELECTRIC	
HYDRANT		MISS DIG – GAS	
BEEHIVE CATCH BASIN		MISS DIG – FIBER	
STORM SEWER MANHOLE		DETECTABLE WARNING STRIP	
SANITARY SEWER MANHOLE			
TELEPHONE MANHOLE		ELECTIRC HANDHOLE	

- OVERHEAD UTILITY LINE
- UNDERGROUND GAS LINE
- TREE LINE
- FENCE LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- BUILDING SETBACK LINES
- WATER LINE
- BITUMINOUS
- GRAVEL
- CONCRETE
- BRICK PAVERS

Location Map
(Not to Scale)



Property Description:

As Supplied:
Commencing at the Northeast corner of Lot 286, North Highland Subdivision, City of Lansing, Ingham County, Michigan; thence North 89 degrees 58 minutes East 408 feet; thence South 577.5 feet; thence South 89 degrees 58 minutes West 377 feet; thence Northwesterly to point on the East line of Lot 301, 54.43 feet North of the Southeast corner; thence North 523.07 feet to the beginning. ALSO Lot 286, EXCEPT the West 2 feet and Lots 289, 290, 291 and 292, ALSO that part of Lots 293 through 298 and 301 lying Easterly of the East right of way line of North Logan Street.

As Surveyed:
Beginning at the Northeast corner of Lot 286, North Highland Subdivision, as recorded in Liber 6 of Plats, Page 14, Ingham County Public records; thence S89°44'19"E along the South line of Ontario Street, 408.10 feet (previously recorded as S89°58'E 408 feet) to the West line of Lansing Avenue; thence S0°25'47"W along said West line of Lansing Avenue, 577.95 feet (previously recorded as South 577.5 feet) to the North line of Willow Street; thence N89°38'35"W along said North line of Willow Street, 377.00 feet (previously recorded as S89°58'W) to the East line of Martin Luther King Jr. Boulevard; thence N30°48'23"W along the East line of said Boulevard, 63.61 feet to to a point on the East line of Lot 301, said point being 54.43 feet North of the Southeast corner of said Lot 301; thence N30°41'51"W along the East line of said Boulevard, 231.51 feet; thence N9°01'58"W along the East line of said Boulevard, 72.91 feet to the Southwest corner of Lot 292; thence N0°26'25"E along the East line of said Boulevard, 143.89 feet (previously recorded as North 144 feet) to the Southwest corner of Lot 288; thence S89°43'15"E along the South line of Lots 288 and 287, 90.04 feet (previously recorded as S89°58'E 90 feet); thence N0°25'49"E 108.44 feet (previously recorded as North 108.5 feet) to the South line of Ontario Street; thence S89°44'19"E along said South line of Ontario Street, 43.51 feet (previously recorded as S89°58'E 43.5 feet) back to the point of beginning.

Benchmark #1:
Set Benchtie in the North Face of Utility Pole Located at the Southeast corner of Subject Property.

Elevation = 849.80'

Benchmark #2:
"X" in East Bolt of Steel Utility Pole Base Located in the Southeast Quadrant of the Intersection of Martin Luther King Jr. Blvd and Willow Street.

Elevation = 849.08'

Benchmark #3:
Top Center of Hydrant Located in the Northeast Quadrant of the Intersection of Ontario Street and Roseneath Ave.

Elevation = 846.15'

Control Point #1:
Set Iron Rod
N: 455159.01
E: 13069878.31
H: 847.85

Control Point #2:
Set Iron Rod
N: 455432.59
E: 13069880.83
H: 851.79

Control Point #3:
Set Iron Rod
N: 455572.19
E: 13069751.43
H: 850.94

Control Point #4:
Set Iron Rod
N: 455446.78
E: 13069503.73
H: 844.52

Control Point #5:
Set Iron Rod
N: 455215.62
E: 13069508.87
H: 845.46

Vertical Datum:
Vertical data referenced to NAVD 88.

Property Area:
6.43 Acres, more or less

Site Address:
1012 Willow Street
Lansing, MI 48915

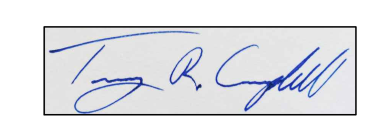
Bearing Basis:
Michigan State Plane Coordinate System - South Zone

Utility Note:
The underground utilities shown have been located from field survey information and existing drawings. The surveyor makes no guarantees that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The surveyor further does not warrant that the the underground utilities shown are in the exact location indicated although he does certify that they are located as accurately as possible from the information available. the surveyor has not physically located the underground utilities other then the structure inventory shown hereon.

Contractor's Note:
The locations of existing underground utilities are shown in an approximate way only. The contractor shall determine the exact location of all existing utilities before beginning work. He agrees to be fully responsible for and and all damages which might be occasioned by his failure to exactly locate and preserve any and all underground utilities. The contractor shall be responsible for adhering to all applicable local, state, and federal standards, Specifications, and guidelines for Construction.

811 Know what's below. Call before you dig.

I Terry R. Campbell, hereby certify to Lansing School District that on October 11, 2022, I have surveyed the above mapped and described property lines and that the Relative Positional Precision of each corner is within the limits accepted by the professional practice of surveying.



Terry R. Campbell, P.S. — ORIGINAL SIGNATURE IN BLUE
Professional Surveyor No.: 60806

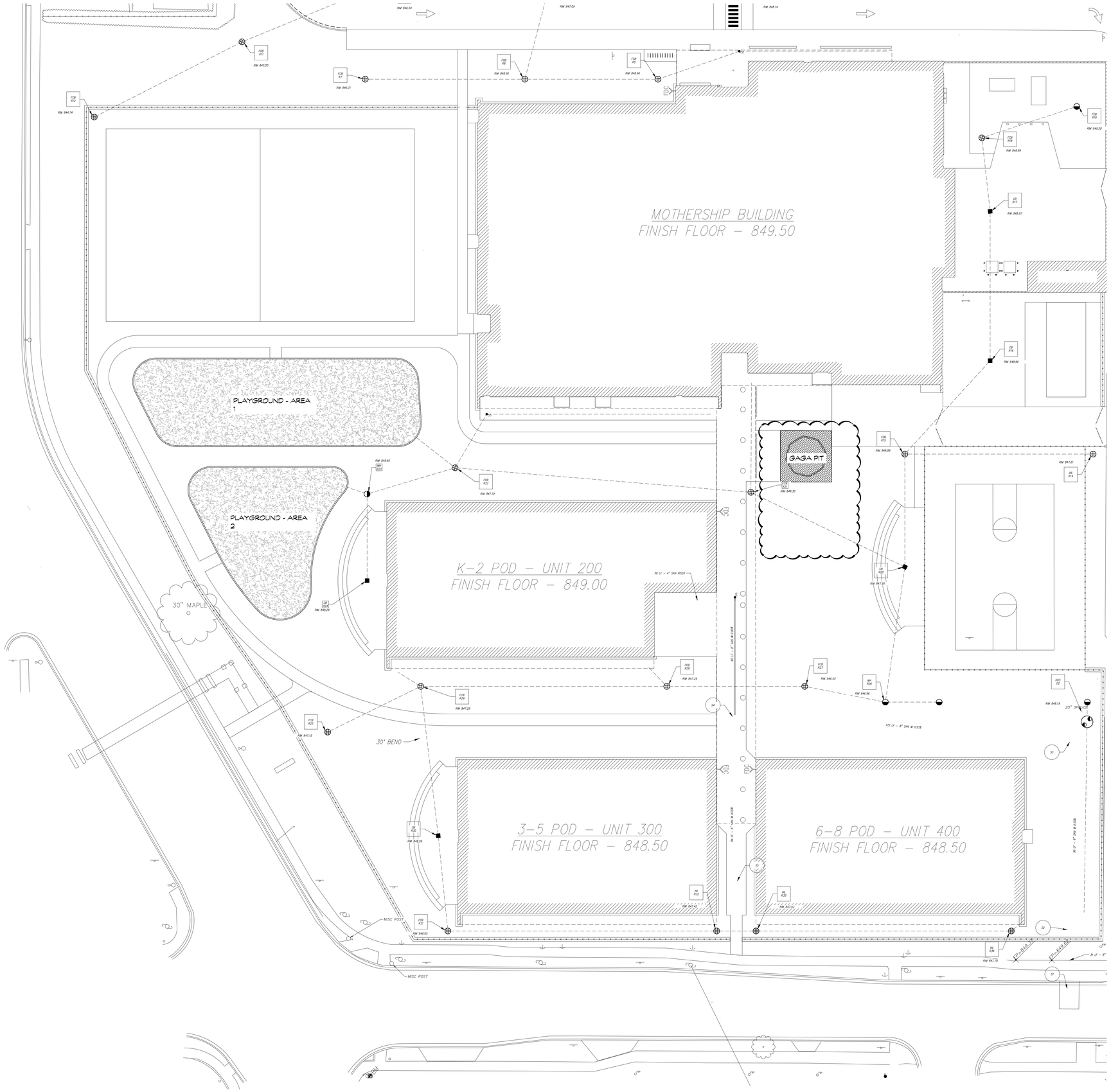
STATE OF MICHIGAN — Terry Richard Campbell — License No. 4001060806 — LICENSED PROFESSIONAL SURVEYOR

OFFICIAL SEAL

Prepared For: Lansing School District
519 Kalamazoo Street
Lansing, MI 48933

Campbell Surveying Engineering, Inc.
Professional Surveying Services
8437 Pineview Lake Drive, Linden, Michigan 48451
www.campbellse.com (989) 390-1189

DATE: November 14, 2022		
SCALE: 1" = 40'		
CLIENT: JOB Lansing School Dist: S22I28A	PAGE: 1 OF 1	REVISED:
DWG NO: S22I28A	DRAWN BY: TRC	CHK:



LEGEND

EXISTING	PROPOSED
SPOT ELEVATION	SPOT GRADE
AS-BUILT SPOT ELEVATION	TOP OF WALL ELEVATION
FENCE	TOP OF CURB ELEVATION
DRAINAGE STRUCTURE	MATCH EXISTING ELEVATION
STORM DRAIN	TOP OF TRENCH ELEVATION
LIGHT POLE	DRAINAGE SWALE
ELECTRICAL	CHAINLINK FENCE - SEE PLANS FOR HT.
WATER	ORNAMENTAL FENCE - SEE PLANS FOR HT.
TELEPHONE	DRAINAGE STRUCTURE
IRRIGATION	STORM DRAIN
PROPERTY	FLAT DRAIN
SANITARY	4" PERFORATED DRAINTILE
GAS	6" PERFORATED DRAINTILE
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	LIGHT POLE
	ELECTRICAL
	WATER
	TELEPHONE
	IRRIGATION
	LIMITS OF CONSTRUCTION
	ALL-WEATHER SURFACE OVER ATHLETIC VIRGIN ASPHALT (2 LIFTS) OVER 21AA LIMESTONE BASE
	RUBBER MAT
	ASPHALT OVERLAY
	NON-REINFORCED CONCRETE OVER COMPACTED SAND BASE
	REINFORCED CONCRETE OVER 21AA LIMESTONE BASE
	TOPSOIL AND SEED
	CRUSHED LIMESTONE ATHLETIC MEAL
	SYNTHETIC TURF
	ENGINEERED WOOD FIBER

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
Addendum 03	03/15/2024

JOB NO. 2616.01A

N

SHEET TITLE

PLAYGROUND OVERALL SITE PLAN

SHEET NO.

L1.00

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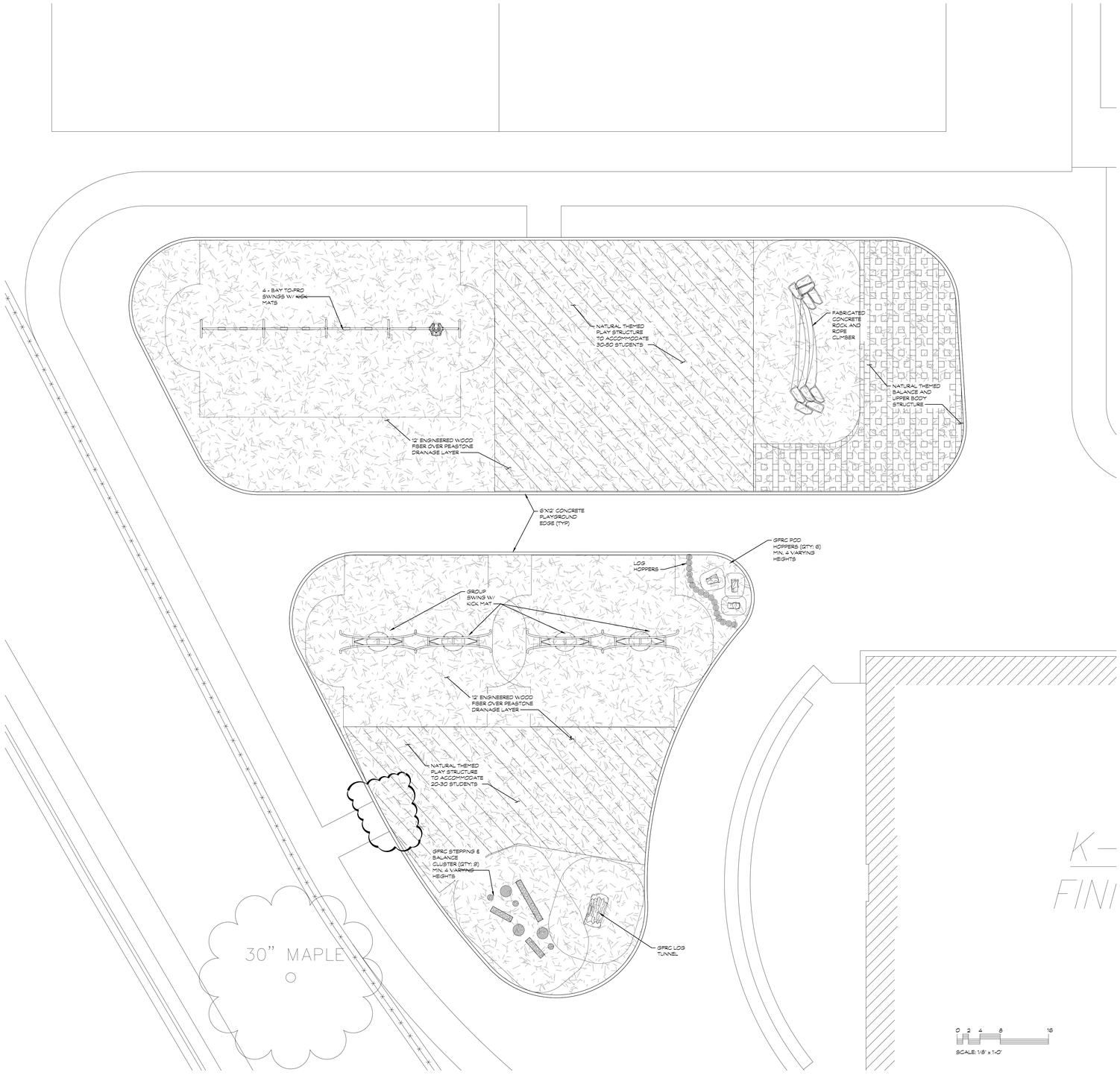


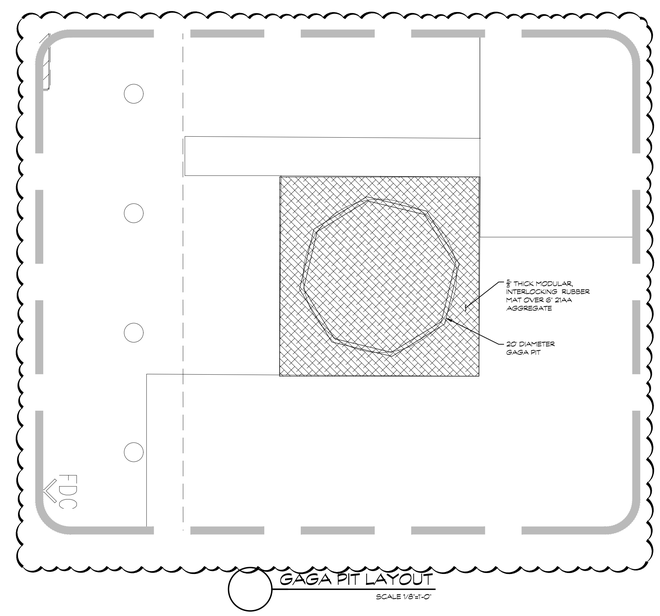
LEGEND

EXISTING

- SPOT ELEVATION
- AS-BUILT SPOT ELEVATION
- FENCE
- DRAINAGE STRUCTURE
- STORM DRAIN
- LIGHT POLE
- ELECTRICAL
- WATER
- TELEPHONE
- IRRIGATION
- PROPERTY
- SANITARY
- GAS

PROPOSED

- SPOT GRADE
- TOP OF WALL ELEVATION
- TOP OF CURB ELEVATION
- MATCH EXISTING ELEVATION
- TOP OF TRENCH ELEVATION
- DRAINAGE SWALE
- CHAINLINK FENCE - SEE PLANS FOR HT.
- ORNAMENTAL FENCE - SEE PLANS FOR HT.
- DRAINAGE STRUCTURE
- STORM DRAIN
- FLAT DRAIN
- 4" PERFORATED DRAINTILE
- 6" PERFORATED DRAINTILE
- 8" PERFORATED DRAINTILE
- LIGHT POLE
- ELECTRICAL
- WATER
- TELEPHONE
- IRRIGATION
- LIMITS OF CONSTRUCTION
- ALL-WEATHER SURFACE OVER ATHLETIC VIRGIN ASPHALT (2 LIFTS) OVER 21AA LIMESTONE BASE
- RUBBER MAT
- ASPHALT OVERLAY
- NON-REINFORCED CONCRETE OVER COMPACTED SAND BASE
- REINFORCED CONCRETE OVER 21AA LIMESTONE BASE
- TOPSOIL AND SEED
- CRUSHED LIMESTONE ATHLETIC MEAL
- SYNTHETIC TURF
- ENGINEERED WOOD FIBER



GAGA PIT LAYOUT
SCALE 1/8"=1'-0"

0 2 4 8 16
SCALE: 1/8" = 1'-0"

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ISSUANCES	DATE
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Addendum 03	03/15/2024

JOB NO. 2616.01A

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SHEET TITLE

PLAYGROUND SITE PLAN

SHEET NO.

L1.01

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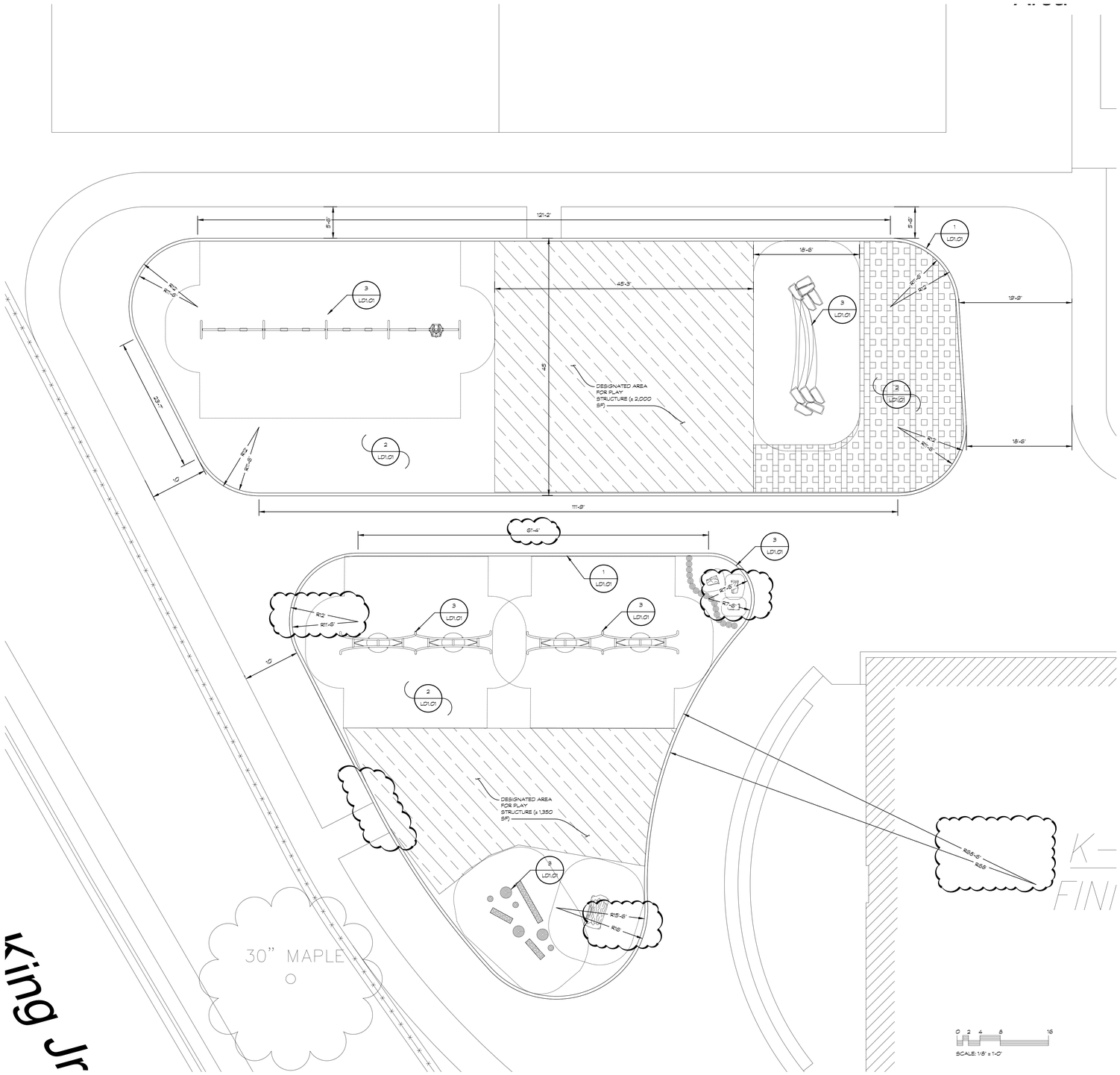

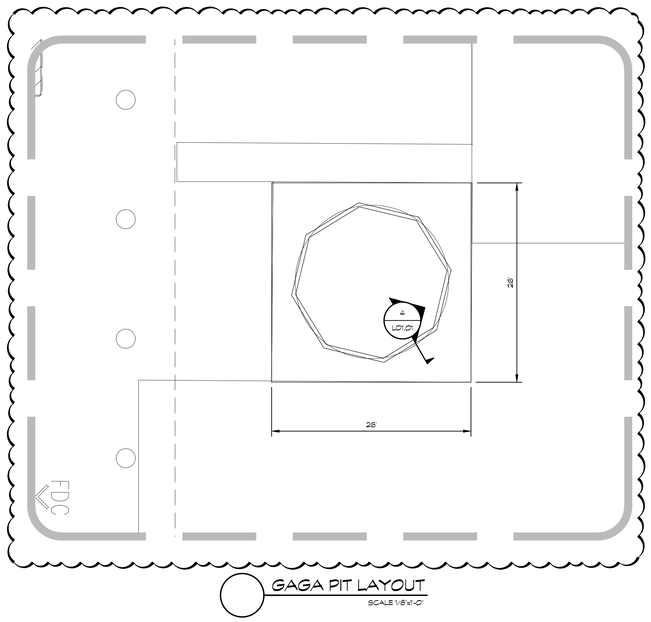

GAGA PIT LAYOUT
SCALE 1/8"=1'-0"

LEGEND

EXISTING	PROPOSED
SPOT ELEVATION	SPOT GRADE
AS-BUILT SPOT ELEVATION	TOP OF WALL ELEVATION
FENCE	TOP OF CURB ELEVATION
DRAINAGE STRUCTURE	MATCH EXISTING ELEVATION
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	ALL-WEATHER SURFACE OVER ATHLETIC VIRGIN ASPHALT (2 LIFTS) OVER 21AA LIMESTONE BASE
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	TOPSOIL AND SEED
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	SYNTHETIC TURF
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King Jr

JOB NO. 2616.01A

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SHEET TITLE

PLAYGROUND DIMENSION PLAN

SHEET NO.

L1.02

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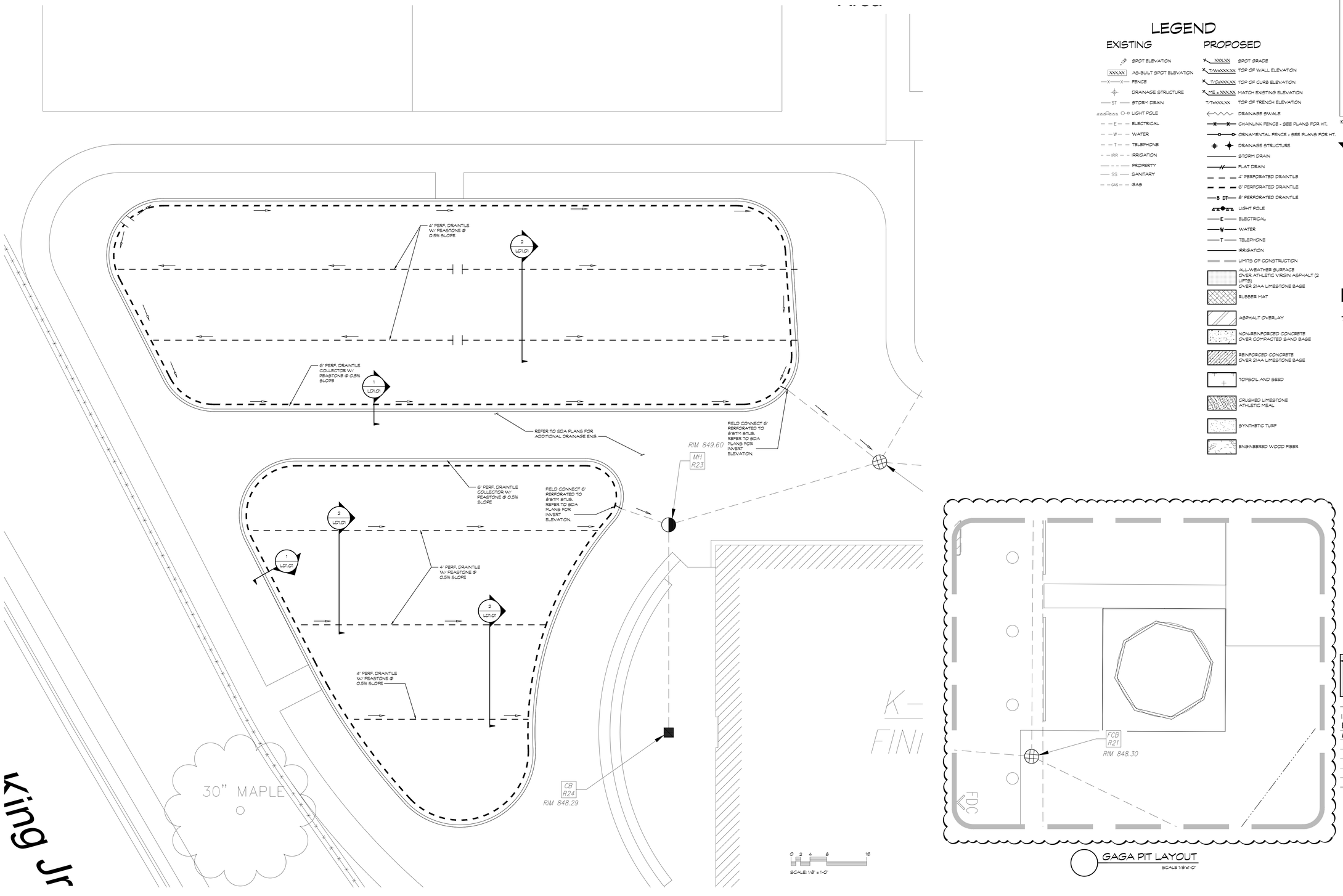

LEGEND

EXISTING	PROPOSED
SPOT ELEVATION	SPOT GRADE
AS-BUILT SPOT ELEVATION	TOP OF WALL ELEVATION
FENCE	TOP OF CURB ELEVATION
DRAINAGE STRUCTURE	MATCH EXISTING ELEVATION
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LIGHT POLE	DRAINAGE SWALE
ELECTRICAL	CHAINLINK FENCE - SEE PLANS FOR HT.
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	SYNTHETIC TURF
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JOB NO. 2616.01A

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SHEET TITLE

PLAYGROUND DRAINAGE PLAN

SHEET NO.

L1.03

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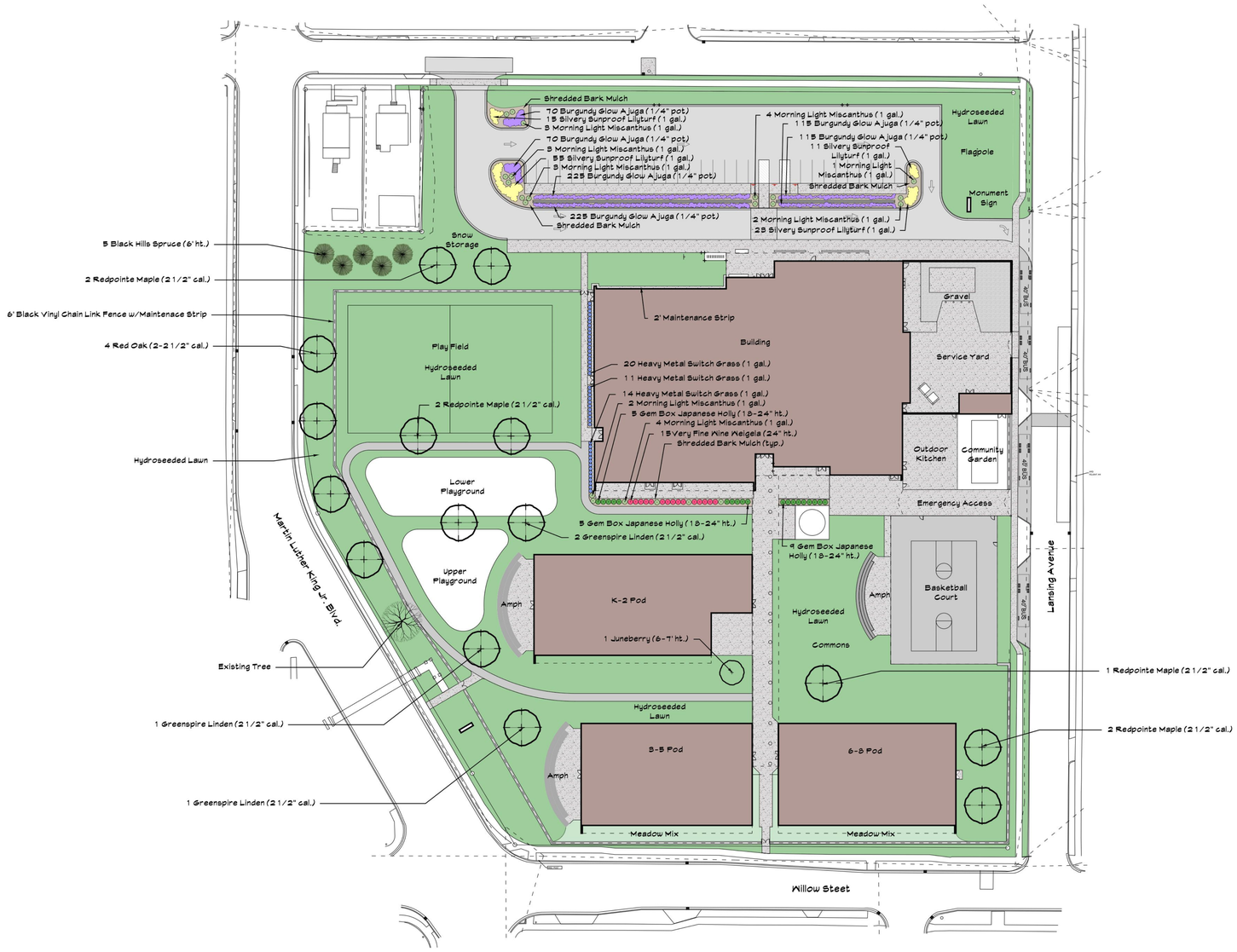
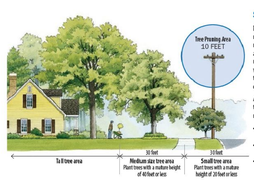


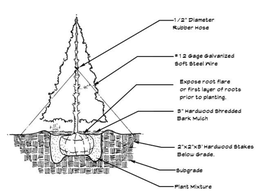


Smart planting

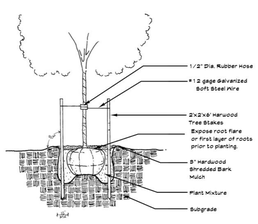
No trees should be planted near power lines. However, many trees are attractive additions to your yard and, under normal conditions, will not grow tall enough to interfere with our distribution lines.

Avoid planting tall-growing trees such as the following near or under power lines:

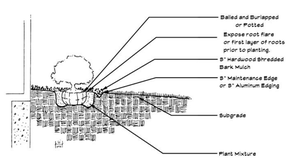
- Silver Maple
- Norway Maple
- Oak
- White Spruce
- Colorado Blue Spruce
- Most pines
- Willows



Evergreen Planting Detail-5' and Taller



Deciduous Trees 3" Caliper and Smaller



Shrub Planting Detail

Landscape Plan
(scale: 1"=40')

0 20 40' 60' 80'

Low Maintenance Meadow Mix
50% CHEWINGS FESCUE
30% HARD FESCUE
20% SHEEP FESCUE

811 Know what's below. Call before you dig.

Notes:

1. All landscaping shall be installed by a qualified Landscape Contractor. Plant sizes specified on the landscape plan shall be the size planted. Plants smaller then specified will be rejected. Substitutions of any kind must be approved by the Landscape Architect.
2. All plantings shall be mulched with 3" shredded premium hardwood bark mulch. Trees in lawn areas shall receive a 6' diameter bark ring 3" deep..
3. The landscape contractor shall remove any twine that is wrapped around the trunk of a tree or shrub as well as the top third of any burlap. Remove excess soil on the top of the root ball to expose the root flare or first layer of roots prior to planting. Use a wire cutter to make 3–5 cuts in the wire basket to allow roots to grow through.
4. When planting trees in the lawn area or on the berm the existing soil within a 10 foot diameter shall be loosened by tilling or similar and amended with composted manure or peat at a depth of 6–12".
5. Planting areas shall be edged with a mechanical bed edger to define a border for the shedded bark mulch.
6. Parking Islands shall be back filled with at least 24" of topsoil. Amend the topsoil with composted manure and mix into the topsoil at a depth of 6–12". Any aggregate or stone from the construction of the parking lot shall be removed prior to backfill.
7. Lawn areas shall recieve at least 4" of topsoil and hydroseeded. Check with specifications for topsoil availability or contact project manager. Topsoil for lawns shall be appropriate for growing and sustaining a healthy lawn. All lawns shall be hydroseeded with a seed blend consisting of 30% Kentucky Bluegrass, 20% Perennial Ryegrass, 10% Hard Fescue, 20% Creeping Red Fescue and 20% Chewings Fescue.
8. Maintenance of the landscape shall be provided for by the owner and include fertilizing of lawn and plant material, yearly pruning, top dressing of mulch areas every other year and provide 1" of water per week during the growing season.
9. Plant materials shall be chosen and installed in accordance with standards recommended by the County Cooperative Extension Service or American Nursery Association.

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1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
JOYCE E. WEISE
LANDSCAPE ARCHITECT
No. 1202
LICENSED LANDSCAPE ARCHITECT

Joyce E. Weise

Landscape Plan Drawn By:
Joyce E. Weise PLA, ASLA

Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024

KEY PLAN

N

JOB NO. 2616.01A

SHEET TITLE

LANDSCAPE PLAN

SHEET NO.

LA1.1

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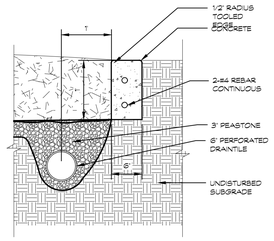
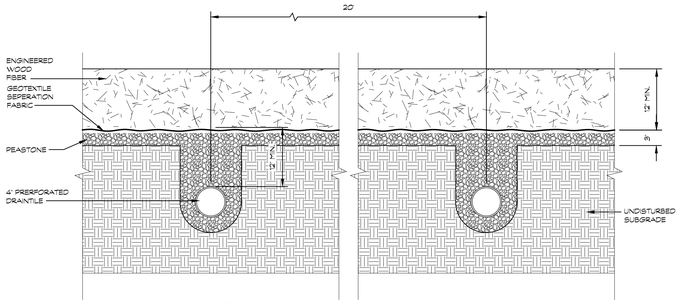


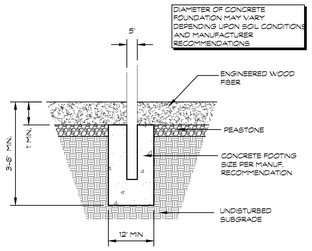
1 PLAY SURFACE CURB DETAIL

SCALE 1"=1'-0"



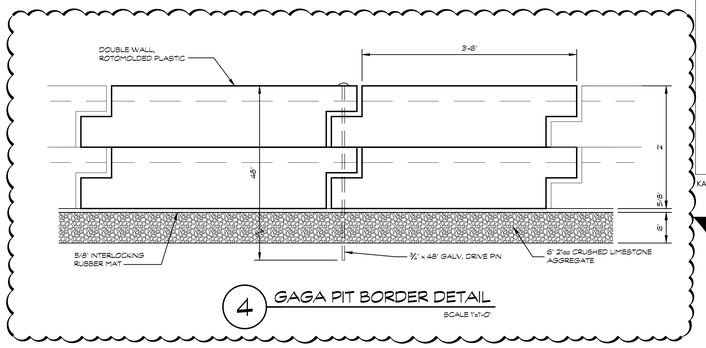
2 4" DRAINTILE SECTION

SCALE 1"=1'-0"



3 POST FOUNDATION

SCALE 3/8"=1'-0"



4 GAGA PIT BORDER DETAIL

SCALE 1"=1'-0"

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Lansing School District

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Lansing School District

ISSUANCES	DATE
BID AND CONSTRUCTION	01.26.2024
Addendum 03	03/15/2024

N

JOB NO. 2616.01A

SHEET TITLE

PLAYGROUND DETAILS

SHEET NO.

LD1.01

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STRUCTURAL NOTES

GENERAL

1. THESE NOTES ARE TO BE READ IN CONJUNCTION WITH THE DRAWINGS AND THE WRITTEN SPECIFICATIONS. IN THE EVENT OF CONFLICT BETWEEN THE INFORMATION ON THE WRITTEN SPECIFICATIONS, THE DRAWINGS, AND THESE NOTES, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN.

2. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE COMPLETED STRUCTURE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ADEQUATE SHORING AND BRACING DURING CONSTRUCTION TO ACCOUNT FOR ALL FORCES, INCLUDING BUT NOT LIMITED TO: GRAVITY, WIND, EARTH PRESSURE, AND UNBALANCED FORCES DUE TO CONSTRUCTION SEQUENCE. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, PROCEDURES, TECHNIQUES, SEQUENCES, AND JOB SAFETY.

3. THE CONTRACTOR SHALL ENSURE THAT ALL CONSTRUCTION METHODS WILL NOT CAUSE DAMAGE TO ADJACENT BUILDINGS, UTILITIES, OR OTHER PROPERTIES.

4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF THE STRUCTURAL WORK WITH THE ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING WORK, AS WELL AS ANY OTHER APPLICABLE TRADES. NOTIFY THE ARCHITECT/ENGINEER OF ANY DISCREPANCIES AND/OR INTERFERENCES IMMEDIATELY.

5. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS BEFORE BEGINNING WORK. CONTRACTOR SHALL TAKE FIELD MEASUREMENTS AND BE RESPONSIBLE FOR SAME.

6. IN CASES OF CONFLICT BETWEEN DRAWINGS AND/OR SPECIFICATIONS AND OTHER DISCIPLINES OR EXISTING CONDITIONS, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER AND OBTAIN CLARIFICATION PRIOR TO BIDDING AND/OR PROCEEDING WITH THE WORK.

7. THE CONTRACTOR SHALL VERIFY ALL OPENING SIZES AND LOCATIONS WITH OTHER DISCIPLINES. THE DRAWINGS DO NOT SHOW ALL OPENINGS REQUIRED. ADDITIONAL OPENINGS, BLOCKOUTS, AND SLEEVES MAY BE REQUIRED BY OTHER DISCIPLINES. OPENINGS REQUIRED BUT NOT SHOWN ON STRUCTURAL DRAWINGS MUST BE APPROVED BY THE STRUCTURAL ENGINEER OF RECORD.

8. APPLY DETAILS, SECTIONS, AND NOTES ON THE DRAWINGS WHERE CONDITIONS ARE SIMILAR TO THOSE INDICATED BY DETAIL, DETAIL TITLE, OR NOTE.

9. DO NOT SCALE DRAWINGS. ONLY USE DIMENSIONS INDICATED ON THE DRAWINGS.

10. ISOMETRIC VIEWS, IF INCLUDED, ARE TO GIVE A GENERAL SENSE OF THE STRUCTURE AND MASSING. THEY DO NOT SUPERSEDE THE STRUCTURAL DRAWINGS AND ARE PROVIDED AS SUPPLEMENTAL INFORMATION ONLY. THE STRUCTURE SHALL BE PROVIDED PER THE STRUCTURAL DRAWINGS, DETAILS, NOTES, AND SPECIFICATIONS.

11. CENTERLINES OF FRAMING MEMBERS COINCIDE WITH COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.

12. CENTERLINES OF FOUNDATIONS COINCIDE WITH COLUMN LOCATIONS, UNLESS NOTED OTHERWISE.

13. THE CONTRACTOR SHALL OBTAIN COPIES OF THE LATEST CONTRACT DOCUMENTS INCLUDING ALL BULLETINS AND ADDENDA, AND SHALL PROVIDE THE RELEVANT PORTIONS TO ALL SUBCONTRACTORS AND SUPPLIERS PRIOR TO SUBMITTAL OF SHOP DRAWINGS, FABRICATION, AND ERECTION OF STRUCTURAL MEMBERS.

14. STRUCTURAL ENGINEER OF RECORD'S ACCEPTANCE MUST BE SECURED FOR ALL STRUCTURAL SUBSTITUTIONS.

15. NO STRUCTURAL MEMBER SHALL BE CUT, NOTCHED, OR OTHERWISE REDUCED IN STRENGTH UNLESS SPECIFICALLY SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD.

16. THE GENERAL CONTRACTOR IS TO PROVIDE AN APPROPRIATE NUMBER OF COPIES OF ONE COMPLETE COORDINATED DRAWING SET SHOWING ALL SLEEVES, CONDUITS, BOXOUTS, DUCT OPENINGS, ETC. AS REQUIRED FOR ALL TRADES FOR THE STRUCTURAL ENGINEER OF RECORD'S APPROVAL. THIS SHALL BE DONE A MINIMUM OF TWO WEEKS PRIOR TO CONSTRUCTING AFFECTED SLABS, BEAMS, WALLS, COLUMNS, OR FOOTINGS.

17. SUPPORT DETAILS FOR, ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING EQUIPMENT IS BASED UPON AVAILABLE INFORMATION OF MANUFACTURER. CONTRACTOR SHALL COORDINATE REQUIREMENTS OF ACTUAL EQUIPMENT SUPPLIED WITH DETAILS AND SHALL PROVIDE ANY ADDITIONAL FRAMING REQUIRED.

18. PERIODIC SITE OBSERVATION VISITS MAY BE PROVIDED BY THE ARCHITECT/ENGINEER. THE SOLE PURPOSE OF THESE OBSERVATIONS IS TO REVIEW THE GENERAL CONFORMANCE OF THE CONSTRUCTION WITH THE CONTRACT DOCUMENTS. THESE LIMITED OBSERVATIONS SHOULD NOT BE CONSIDERED AS CONTINUOUS OR EXHAUSTIVE INVESTIGATIONS TO VERIFY THAT ALL CONSTRUCTION IS IN COMPLIANCE WITH THE CONTRACT DOCUMENTS.

REFERENCED CODES AND STANDARDS

1. PERFORM ALL CONSTRUCTION IN CONFORMANCE WITH THE LATEST EDITIONS OF THE BUILDING AND DESIGN CODES REFERENCED WITHIN THESE DOCUMENTS. THE CONTRACT DOCUMENTS REFER TO THE FOLLOWING CODES AND STANDARDS, LATEST EDITIONS AS REFERENCED IN THE CURRENT BUILDING CODE IN THE STATE OF THE PROJECT, UNLESS NOTED OTHERWISE:
   - 2015 MICHIGAN BUILDING CODE
   - ASCE 7, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
   - ACI 301, SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS
   - ACI 318, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
   - TMS 402/602, BUILDING CODE REQUIREMENTS AND SPECIFICATION FOR MASONRY STRUCTURES
   - HOT AND COLD WEATHER MASONRY CONSTRUCTION BY THE MASONRY INDUSTRY COUNCIL
   - AISC 303, CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES
   - AISC 360, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS
   - ANSI/SDI RD, STANDARD FOR STEEL ROOF DECK
   - SJI, STANDARD SPECIFICATION FOR OPEN WEB STEEL JOISTS AND JOIST GIRDERS
   - AISI S100, NORTH AMERICAN SPECIFICATIONS FOR THE DESIGN OF COLD-FORMED STEEL MEMBERS

DESIGN CRITERIA

1. GENERAL
   - CONCRETE DESIGN — LRFD
   - STEEL DESIGN — LRFD
   - MASONRY DESIGN — ASD
   - RISK CATEGORY — III

2. DEAD LOADS (SUPERIMPOSED)
   - MEP, CEILINGS, LIGHTS — 15.0 PSF
   - SOLAR PANELS — 5.0 PSF

3. LIVE LOADS
   - ROOF — 20.0 PSF

4. SNOW LOADS
   - GROUND SNOW LOAD (P_G) — 30.0 PSF
   - SNOW EXPOSURE FACTOR (C_E) — 0.9
   - SNOW IMPORTANCE FACTOR (I_S) — 1.1
   - THERMAL FACTOR (C_T) — 1.0
   - FLAT ROOF SNOW LOAD (P_F) — 20.8 PSF
   - SLOPED ROOF SNOW LOAD (P_S) — 20.8 PSF
   - MINIMUM FLAT SNOW LOAD (P_{MIN}) — 22.0 PSF

5. WIND LOADS
   - BASIC WIND SPEED (V) — 120 MPH
   - EXPOSURE CATEGORY — B
   - (SEE WIND LOAD DIAGRAMS)

6. EARTHQUAKE LOADS
   - SEISMIC SITE CLASS — D
   - DESIGN SPECTRAL ACCELERATION (S_{DS}) — 0.098
   - DESIGN SPECTRAL ACCELERATION (S_{D1}) — 0.074
   - SEISMIC DESIGN CATEGORY — B
   - SEISMIC IMPORTANCE FACTOR (I_E) — 1.25
   - SHEATHED COLD-FORMED STEEL SHEAR WALLS (R) — 6.5
   - SEISMIC RESPONSE COEFFICIENT (C_S) — 0.019

SUBMITTALS

1. THE CONTRACTOR SHALL SUBMIT FOR ARCHITECT/ENGINEER REVIEW A SCHEDULE WHICH DETAILS THE ESTIMATED QUANTITY OF SUBMITTALS, AND THE DATE THEY WILL BE RECEIVED, AT LEAST TWENTY (20) WORKING DAYS PRIOR TO THE FIRST SUBMITTAL. THE SCHEDULE SHOULD ACCOUNT FOR AT LEAST TEN (10) WORKING DAYS OF REVIEW TIME BY THE ARCHITECT/ENGINEER FOR EACH SUBMITTAL.

2. SHOP DRAWINGS AND/OR DETAILS THAT ARE PREPARED FROM REPRODUCTIONS OF THE STRUCTURAL ENGINEER OF RECORD'S DESIGN DOCUMENTS, IN WHOLE OR IN PART, SHALL NOT BE USED AND WILL BE REJECTED.

3. THE ARCHITECT/ENGINEER MAY RETURN, WITHOUT COMMENT, SUBMITTALS WHICH THE CONTRACTOR HAS NOT STAMPED OR WHICH DO NOT MEET THE PROJECT REQUIREMENTS.

4. THE CONSTRUCTION, MANUFACTURE, AND/OR FABRICATION OF ANY ITEMS PRIOR TO THE ARCHITECT/ENGINEER REVIEW WILL BE ENTIRELY AT THE RISK OF THE CONTRACTOR.

5. ARCHITECT'S/ENGINEER'S REVIEW IS FOR GENERAL CONFORMANCE AND COMPLIANCE WITH THE DESIGN CONCEPT AND CONTRACT DOCUMENTS. ANY ACTION NOTED DOES NOT WAIVE ANY REQUIREMENT OF CONTRACT DOCUMENTS, COORDINATION OF TRADES, AND SATISFACTORY PERFORMANCE OF THEIR WORK WHICH ARE THE CONTRACTOR'S COMPLETE RESPONSIBILITY.

6. FOR COMPONENTS THAT REQUIRE A SPECIALTY ENGINEER, THE SUBMITTAL SHALL BE SEALED BY THE ENGINEER RESPONSIBLE FOR THE DESIGN. "SPECIALTY ENGINEER" IS DEFINED AS THE STRUCTURAL ENGINEER EMPLOYED BY THE SUPPLIER TO DESIGN PRODUCTS TO MEET THE SPECIFIC CRITERIA OUTLINED IN THE CONTRACT DOCUMENTS. SEALING OF THE SUBMITTAL IMPLIES THAT THE SPECIALTY ENGINEER HAS REVIEWED THE CONTRACT DOCUMENTS AND HAS, TO THE BEST OF THEIR KNOWLEDGE, INCORPORATED ALL OF THE SPECIAL DESIGN CRITERIA CONTAINED THEREIN.

7. ITEMS THAT REQUIRE SUBMITTAL FOR STRUCTURAL REVIEW ARE:
   - CONCRETE MIX DESIGNS
   - CONCRETE REINFORCING LAYOUT
   - MASONRY UNIT STRENGTHS
   - MORTAR/GROUT MIX DESIGNS
   - MASONRY REINFORCING LAYOUT
   - METAL DECK
   - METAL JOISTS AND GIRDERS
   - ANCHOR RODS
   - STRUCTURAL STEEL
   - COLD-FORMED METAL FRAMING
   - CURTAIN WALL

FOUNDATIONS

1. FOUNDATION CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE SOIL REPORT BY SOIL AND MATERIALS ENGINEER, 2663 EATON RAPIDS ROAD, LANSING, MICHIGAN DATED JULY 26, 2023 (SME JOB NO. 092683.00). THE CONTRACTOR SHALL OBTAIN A COPY OF THE SOIL REPORT AND BECOME FAMILIAR WITH THE REQUIREMENTS AND RECOMMENDATIONS THEREIN.

2. A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER SHALL BE RETAINED BY THE CONTRACTOR TO VERIFY FOUNDATION INSTALLATION AND CONSTRUCTION IS IN CONFORMANCE WITH THE RECOMMENDATIONS OUTLINED IN THE GEOTECHNICAL INVESTIGATION REPORT.

3. ALL FOOTINGS SHALL BEAR ON UNDISTURBED SOIL, HAVING A MINIMUM SAFE BEARING CAPACITY OF 2,000 PSF.

4. CONTRACTOR SHALL NOTIFY THE GEOTECHNICAL ENGINEER WHEN EXCAVATIONS ARE COMPLETED SO THAT CONDITIONS MAY BE INSPECTED PRIOR TO PLACEMENT OF ANY FILL, REINFORCING, OR CONCRETE. NOTIFY ARCHITECT/ENGINEER OF ANY VARIATION FROM THE ANTICIPATED BEARING CAPACITY FOR APPROPRIATE REDESIGN OR LOWERING OF FOOTING.

5. THE BOTTOMS OF ALL EXTERIOR FOOTINGS SHALL BE MINIMUM 3'-6" BELOW FINISHED GRADE. IF THE BUILDING WILL BE UNDER CONSTRUCTION DURING FREEZING WEATHER, THE BOTTOMS OF ALL INTERIOR FOUNDATIONS SHALL BE DEPRESSED 3'-6" BELOW CONSTRUCTION GRADE FOR FROST PROTECTION. IF SUCH ADDITIONAL FOOTING DEPTH WILL CAUSE UNDERMINING OF ADJACENT EXISTING FOOTINGS OR STRUCTURES, PROVIDE SHORING, BRACING, OR UNDERPINNING AS REQUIRED, OR LEAVE FOOTING ELEVATION AS DESIGNED AND PROVIDE CONTINUED PROTECTION AND HEAT TO PREVENT FORMATION OF FROST BELOW FOOTING AND ADJACENT TO FOOTING.

6. EDGES OF FOOTINGS SHALL NOT BE PLACED AT A GREATER THAN 1 VERTICAL TO 2 HORIZONTAL SLOPE WITH RESPECT TO ANY ADJACENT FOOTING OR EXCAVATION, UNLESS UNDERPINNING OR SHORING AND BRACING OF EXISTING FOOTING OR EXCAVATION IS PROVIDED. UNDERPINNING SHALL BE DONE SO AS NOT TO CAUSE SETTLEMENTS OF EXISTING STRUCTURE AND SHALL BE SUCH THAT COMPLETE CONTACT IS ACHIEVED BETWEEN NEW UNDERPINNING AND EXISTING CONCRETE.

7. DO NOT BACKFILL AGAINST CANTILEVERED RETAINING WALLS OR BASEMENT WALLS UNTIL CONCRETE HAS ATTAINED 100 PERCENT OF ITS DESIGN STRENGTH. DO NOT PLACE BACKFILL AGAINST FOUNDATION WALLS UNTIL BASEMENT SLAB ON GRADE AND FIRST FLOOR STRUCTURE ARE IN PLACE. SHORE AND BRACE WALLS AS REQUIRED IF BACKFILLING OPERATIONS ARE TO BE CARRIED OUT PRIOR TO PLACEMENT OF BASEMENT SLAB AND/OR FLOOR STRUCTURE.

8. BACKFILL FOUNDATION WALLS WITH EARTH ON BOTH SIDES OF THE WALL BY ALTERNATELY PLACING BACKFILL ON EACH SIDE SUCH THAT HEIGHT OF BACKFILL DOES NOT DIFFER BY MORE THAN 1'-0" FROM EITHER SIDE.

9. NO FOUNDATIONS OR SLABS SHALL BE PLACED ON OR AGAINST SUB-GRADE CONTAINING WATER, FROST, OR ICE. CONTRACTOR SHALL FURNISH ALL REQUIRED DE-WATERING EQUIPMENT TO MAINTAIN A DRY EXCAVATION UNTIL BACKFILL IS COMPLETE.

10. CONTRACTOR SHALL BE RESPONSIBLE TO ADEQUATELY PROTECT EXCAVATIONS AND SUB-GRADES OF COMPLETED NON-FROST PROTECTED FOUNDATIONS AND SLABS FROM DAMAGE DUE TO FREEZING CONDITIONS UNTIL THE FULL BUILDING ENCLOSURE IS COMPLETED AND HEATED.

11. SLABS ON GRADE SHALL REST ON A MINIMUM OF SIX (6) INCHES GRANULAR FILL. ALL BACKFILL WITHIN BUILDING LINES SHALL BE ENGINEERED GRANULAR FILL PLACED UNDER THE FULL-TIME SUPERVISION OF A SOIL ENGINEER AND SHALL BE COMPACTED TO ACHIEVE 95% MODIFIED PROCTOR DENSITY (AS DEFINED BY ASTM D1557 MODIFIED PROCTOR TEST). FILL SHALL BE PLACED IN 9" MAXIMUM LIFTS.

12. THE CONTRACTOR SHALL SAFEGUARD AND PROTECT ALL EXCAVATIONS, ADJACENT STRUCTURES, PAVEMENTS, AND UTILITIES. DO NOT REMOVE SHORING, SUCH AS SHEET PILING, IF IT WILL CAUSE SETTLEMENT OR DAMAGE TO EXISTING OR NEW STRUCTURES, PAVEMENT, AND/OR UTILITIES.

13. MAXIMUM LENGTH OF FOUNDATION WALL PLACED IN ONE OPERATION SHALL NOT EXCEED 60 FEET.

14. THE FOUNDATION CONTRACTOR SHALL REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR ALL LOCATIONS OF TRENCHES, PITS, CONDUITS, ETC. NOT SHOWN ON THE STRUCTURAL DRAWINGS.

CONCRETE

1. ALL CONCRETE SHALL BE MADE WITH PORTLAND CEMENT AND STONE AGGREGATE, WITH MIXES DESIGNED TO MEET 28-DAY MINIMUM COMPRESSIVE STRENGTHS IN VARIOUS ELEMENTS OF THE STRUCTURE AS FOLLOWS, UNLESS NOTED OTHERWISE:

ELEMENT	F'C	TYPE	MAX. AGG.	MAX. W/C	MAX. SLUMP
FOOTINGS	3,000	I/II	1 1/2"	0.49	4" (+/- 1")
WALLS AND PIERS	4,500	I/II	3/4"	0.46	4" (+/- 1")
INT. SLAB ON GRADE	4,000	I/II	3/4"	0.46	4" (+/- 1")

2. ALL CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF THE AMERICAN CONCRETE INSTITUTE ACI 301, 318, AND SP-66 (315 INCLUDED AS A CHAPTER), LATEST EDITIONS.

3. PROVIDE NORMAL WEIGHT CONCRETE WITH CURED DENSITY OF 145 PCF AND AGGREGATE CONFORMING TO ASTM C33, UNLESS NOTED OTHERWISE.

4. CONCRETE EXPOSED TO MOISTURE AND FREEZING-AND-THAWING CYCLES (WITH OR WITHOUT EXPOSURE TO DE-ICING CHEMICALS) SHALL BE AIR-ENTRAINED.

5. THE USE OF CALCIUM CHLORIDE AND/OR OTHER CHLORIDE CONTAINING AGENTS IS PROHIBITED. THE USE OF RECYCLED CONCRETE IS PROHIBITED. PLACEMENT WITHIN AND CONTACT BETWEEN ALUMINUM ITEMS AND CONCRETE IS PROHIBITED.

6. NO CONCRETE SHALL BE PLACED UNTIL CONCRETE DESIGN MIXES AND PREVIOUS TESTS HAVE BEEN SUBMITTED FOR EACH CLASS OF CONCRETE NOTED ABOVE AND HAVE BEEN APPROVED BY THE STRUCTURAL ENGINEER OF RECORD. CONCRETE PROPORTIONS SHALL BE BASED UPON FIELD EXPERIENCE AND/OR TRIAL BATCHES PER ACI 301 AND ACI 318. THE CONTROLLED CONCRETE TO BE USED SHALL CONFORM TO THE APPROVED DESIGN MIX. THE USE OF ANY ADDITIVES NOT PRESENT IN THE DESIGN MIX IS PROHIBITED. REPRESENTATIVE TEST CYLINDERS WILL BE TAKEN FROM THE CONCRETE PLACED EACH DAY IN ACCORDANCE WITH THE CONCRETE SPECIFICATIONS.

7. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING DRAWINGS FOR REVIEW OF ALL JOINTS IN THE CONCRETE WORK INCLUDING CONSTRUCTION, EXPANSION, CONTRACTION, AND MOVEMENT JOINTS. DRAWINGS SHALL BE SUBMITTED AT LEAST TWO WEEKS PRIOR TO EXPECTED START OF WORK. JOINT LOCATIONS SHALL COMPLY WITH RECOMMENDATIONS AND REQUIREMENTS DESCRIBED IN ACI 224, LATEST EDITION.

8. ALL CONCRETE STRUCTURAL MEMBERS SHALL BE PLACED FOR THEIR FULL DEPTHS IN ONE OPERATION. CONSTRUCTION JOINTS, SUCH AS DAY'S END PLACEMENT JOINTS, SHALL BE LOCATED IN THE MIDDLE THIRD OF THE SPAN AND BE ROUGHENED. REINFORCING TO RUN THROUGH THE JOINT, BULKHEAD, AND/OR KEY JOINTS. REMOVE LAITANCE PRIOR TO NEXT POUR.

9. ALL CONCRETE SHALL INCLUDE REINFORCEMENT. IF REINFORCEMENT IS NOT SPECIFICALLY INDICATED ON THE DRAWINGS, VERIFY WITH THE STRUCTURAL ENGINEER OF RECORD.

10. CONCRETE SHALL NOT BE PLACED UNTIL PREPARATIONS HAVE BEEN APPROVED BY THE TESTING AND INSPECTION AGENCY INCLUDING FORMWORK, REINFORCEMENT, EMBEDMENTS, AND ACCESSORIES.

CONCRETE REINFORCEMENT

1. REINFORCEMENT SHALL CONFORM TO THE FOLLOWING STANDARDS AND MATERIAL PROPERTIES.
   - DEFORMED BARS — ASTM A615, GRADE 60
   - WELDED WIRE REINFORCEMENT — ASTM A1064

2. UNLESS NOTED OTHERWISE, THE CONCRETE COVER FOR REINFORCEMENT IN CAST-IN-PLACE CONCRETE SHALL NOT BE LESS THAN THE FOLLOWING:
   - CAST AGAINST EARTH — 3"
   - EXPOSED TO EARTH/WEATHER — 2"
   - SLABS, WALLS, AND JOISTS (NO. 11 BARS & SMALLER) — 3/4"
   - BEAMS AND COLUMNS/PIERS
     - TIES, STIRRUPS, SPIRALS — 1 1/2"

3. DETAIL REINFORCEMENT BASED ON THE PROJECT REQUIREMENTS, ACI 318, ACI 315R, AND THE ACI DETAILING MANUAL SP-066, LATEST EDITIONS.

4. WHERE A 90-DEGREE, 135-DEGREE, OR 180-DEGREE HOOK IS GRAPHICALLY INDICATED, PROVIDE CORRESPONDING ACI STANDARD HOOKS, UNLESS NOTED OTHERWISE.

5. DOWELS SHALL MATCH SIZE AND SPACING OF MAIN REINFORCEMENT, UNLESS NOTED OTHERWISE.

6. UNLESS NOTED OTHERWISE, ALL LAP SPLICES ARE TO BE CLASS B TENSION LAP SPLICES EXCEPT THE MINIMUM LAP LENGTH SHALL BE 24".

7. LAP WELDED WIRE REINFORCEMENT TWO PANEL SPACES. WIRE MESH SHALL BE SUPPORTED ON CHAIRS SO THAT PROPER COVER IS MAINTAINED. DO NOT USE THE METHOD OF PULLING UP WITH A HOOK DURING CONCRETE POURING TO POSITION THE REINFORCING.

8. UNLESS NOTED OTHERWISE, TERMINATE BARS AT DISCONTINUOUS ENDS WITH STANDARD HOOKS.

SAW CUTTING EXISTING CONCRETE AND/OR MASONRY

1. SAW CUTTING OF NEW OPENINGS IN EXISTING CONCRETE AND/OR MASONRY WALLS SHALL BE DONE WITHOUT OVERCUTTING BEYOND THE BOUNDARIES OF THE INTENDED OPENING. ANY STRUCTURAL REPAIRS REQUIRED BY THE STRUCTURAL ENGINEER OF RECORD AS A RESULT OF OVERCUTTING BEYOND THE BOUNDARIES OF AN OPENING SHALL BE PAID FOR BY THE SAW CUTTING CONTRACTOR. SEE DRAWINGS FOR ADDITIONAL INFORMATION.

BRICK MASONRY

1. BRICK MASONRY CONSTRUCTION SHALL CONFORM TO THE LATEST EDITIONS OF THE FOLLOWING STANDARDS:
   - BUILDING CODE REQUIREMENTS AND SPECIFICATION FOR MASONRY STRUCTURES, TMS 402/602.
   - TECHNICAL NOTES ON BRICK CONSTRUCTION, TECHNICAL NOTES 1-48, BIA.
   - GUIDE SPECIFICATION FOR BRICK MASONRY, TECHNICAL NOTES 11A-E, BIA.
   - HOT AND COLD WEATHER MASONRY CONSTRUCTION BY THE MASONRY INDUSTRY COUNCIL.

2. BRICK UNITS FOR EXTERIOR USE AS A VENEER SHALL CONFORM TO ASTM C216 GRADE SW, WITH THE FOLLOWING EXCEPTIONS:
   - THE SATURATION COEFFICIENT (C/B) REQUIREMENT SHALL NOT BE WAIVED AS ALLOWED IN SECTIONS 5.1 AND 5.2 UNLESS ENGINEERING DATA AND FIELD RECORDS CAN BE PROVIDED WHICH DEMONSTRATES THE UNITS TO BE SUFFICIENTLY DURABLE AND RESISTANT TO FREEZE-THAW DETERIORATION.
   - INITIAL RATE OF ABSORPTION (IRA) SHALL NOT EXCEED 20 GRAMS PER MINUTE PER 30 SQUARE INCHES OF FACE AREA. FOR COLD WEATHER CONSTRUCTION, THE BRICKS SHALL HAVE A MINIMUM IRA OF 6 GRAMS PER MINUTE PER 30 SQUARE INCHES OF FACE AREA.

3. BRICK MANUFACTURER OR DISTRIBUTOR SHALL PROVIDE THE ARCHITECT WITH BRICK TEST DATA, CERTIFICATE OF COMPLIANCE WITH ASTM C216 GRADE SW, AND THE ABOVE NOTED EXCEPTIONS. BRICK UNITS SHALL NOT BE SHIPPED TO THE SITE UNTIL APPROVAL HAS BEEN RECEIVED FROM THE ARCHITECT.

4. MORTAR FOR BRICK MASONRY SHALL CONFORM TO ASTM C270. MORTAR SHALL BE TYPE M FOR ALL BELOW GRADE UNITS AND TYPE N ABOVE GRADE.

5. IN CMU AND BRICK CAVITY WALLS, PROVIDE CONTINUOUS LADDER TYPE HORIZONTAL JOINT REINFORCING AT 16" OC VERTICAL SPACING WITH ADJUSTABLE VENEER TIE SYSTEM AT 16" OC HORIZONTAL SPACING. THE SYSTEM SHALL PERMIT MOVEMENT OF THE TIE BOTH VERTICALLY AND HORIZONTALLY WITHIN THE PLANE OF THE WALL, BUT SHALL PREVENT MOVEMENT NORMAL TO THE PLANE OF THE WALL.

6. AT CONCRETE WALLS WITH BRICK VENEER, PROVIDE CONTINUOUS VERTICAL DOVETAIL SLOT ANCHORS AT 16" OC HORIZONTAL SPACING WITH TRIANGULAR WIRE TIES INTO THE VENEER AT 16" OC VERTICAL SPACING.

CONCRETE MASONRY

1. LOAD BEARING AND BACKUP WALL CONCRETE MASONRY CONSTRUCTION SHALL CONFORM TO THE FOLLOWING MATERIAL STANDARDS:
   - CONCRETE BLOCK — ASTM C90, NORMAL WEIGHT, TYPE 1
   - MORTAR — ASTM C270, TYPE M OR S PORTLAND/LIME
   - GROUT — ASTM C476 (3,000 PSI AT 28-DAYS)
   - REINFORCEMENT — ASTM A615, GRADE 60, (MIN. 24" LAP)
   - JOINT REINFORCEMENT — ASTM A951, LADDER TYPE, (MIN 9-GAGE), GALV.

2. UNLESS NOTED OTHERWISE, THE MASONRY COVER FOR REINFORCEMENT SHALL NOT BE LESS THAN THE FOLLOWING:
   - MASONRY FACE EXPOSED TO WEATHER
     - NO.6 BAR AND LARGER — 2"
     - NO.5 BAR AND SMALLER — 1 1/2"
   - MASONRY FACE NOT EXPOSED TO WEATHER — 1 1/2"
   - GALVANIZED WIRE JOINT REINFORCING — 3/4"

3. CONCRETE MASONRY ASSEMBLAGE SHALL DEVELOP 2,500 PSI COMPRESSIVE STRENGTH IN 28-DAYS, UNLESS NOTED OTHERWISE.

4. MORTAR FOR CONCRETE MASONRY SHALL BE TYPE M FOR ALL BELOW GRADE UNITS AND TYPE S AT ABOVE GRADE UNITS.

5. CALCIUM CHLORIDE SHALL NOT BE USED IN MORTAR OR GROUT.

6. LAY MASONRY IN RUNNING BOND, UNLESS NOTED OTHERWISE.

7. HOLLOW-UNIT MASONRY SHALL HAVE FACE SHELL BEDDING EXCEPT AT PIERS, COLUMNS, PILASTERS, THE COURSE IMMEDIATELY ABOVE FOUNDATIONS, AND WHERE CONTAINMENT OF GROUT OR LOOSE FILL INSULATION REQUIRES THAT WEB AND FACE SHELLS BE MORTARED. IN FULLY GROUTED OR UN-GROUTED MASONRY, ONLY THE FACE SHELLS NEED TO BE MORTARED.

8. PLACE LADDER TYPE HORIZONTAL JOINT REINFORCING WITH PREFORMED LAPPED CORNER REINFORCING AT 16" OC VERTICALLY IN ALL MASONRY WALLS U.O.N.

9. WALL SHALL BE REINFORCED VERTICALLY AS SHOWN ON STRUCTURAL DRAWINGS. REINFORCING SHALL BE FULLY GROUTED IN PLACE.

10. WALLS SHALL BE REINFORCED VERTICALLY AT WALL ENDS, CORNERS, AND ALL AROUND DOOR AND WINDOW OPENINGS WITH (2) #5 BARS, UNLESS NOTED OTHERWISE.

11. PROVIDE A CONTINUOUS BOND BEAM WITH (2) #5 BARS CONTINUOUS IN THE TOP COURSE OF ALL BLOCK WALLS, AT LOCATIONS WHERE FRAMING MEMBERS ARE BOLTED TO FACE OF CMU WALLS, BELOW BEAM BEARINGS, AND AT LOCATIONS INDICATED ON THE DRAWINGS. BOND BEAMS SHALL HAVE CORNER BARS AROUND CORNERS AND AT WALL INTERSECTIONS.

12. FILL ALL VOIDS AND BLOCK CELLS SOLIDLY WITH GROUT FOR A DISTANCE OF 24-INCHES BENEATH AND 16-INCHES EACH SIDE OF ALL BEAM REACTIONS OR OTHER CONCENTRATED LOADS, UNLESS NOTED OTHERWISE. GROUT SHALL BE VIBRATED AND RE-VIBRATED AFTER INITIAL WATER LOSS TO ENSURE COMPLETE FILLING OF CORES.

13. VERTICAL CONTROL JOINTS OF A KEY TYPE AS INDICATED ON THE PLANS ARE TO BE PLACED IN ALL MASONRY WALLS AT INTERVALS NOT TO EXCEED 24 FEET APART. THE CONTRACTOR SHALL FURNISH A CONTROL JOINT LOCATION PLAN FOR THE ARCHITECT'S APPROVAL IF THE PLANS DO NOT SUFFICIENTLY DESCRIBE THE LOCATION OF ALL REQUIRED CONTROL JOINTS.

EXISTING MASONRY - PATCHING, FILLING-IN, REBUILDING, TUCK POINTING

1. ALL MASONRY CONSTRUCTION SHALL CONFORM TO:
   - BUILDING CODE REQUIREMENTS AND SPECIFICATION FOR MASONRY STRUCTURES, TMS 402/602.
   - TECHNICAL NOTES ON BRICK CONSTRUCTION, TECHNICAL NOTES 1-48, BIA.
   - GUIDE SPECIFICATION FOR BRICK MASONRY, TECHNICAL NOTES 11A-E, BIA.
   - HOT AND COLD WEATHER MASONRY CONSTRUCTION BY THE MASONRY INDUSTRY COUNCIL.

2. NEW MASONRY CONSTRUCTION SHALL BE SOLIDLY TOOTHED INTO EXISTING MASONRY TO THE FULL THICKNESS OF THE EXISTING CONSTRUCTION. SEE DRAWINGS FOR FURTHER NOTES AND DETAILS.

3. MORTAR FOR TOOTHING IN, REPAIRING, AND TUCK POINTING SHALL CONFORM TO ASTM C270. MORTAR TO BE TYPE N WITH THE HIGHEST PERMISSIBLE LIME CONTENT.

4. NEW MULTI-WYTHE MASONRY WALL SECTIONS SHALL BE CONSTRUCTED SIMILAR TO THE EXISTING CONSTRUCTION. BOND IN MULTI-WYTHE BRICK WALLS SHALL BE ACCOMPLISHED THROUGH THE USE OF MASONRY HEADER COURSES BETWEEN WYTHES AT EVERY SIXTH COURSE. THE COLLAR JOINTS OF ALL WALLS SHALL BE FILLED SOLIDLY WITH MORTAR AS THE WALL IS BUILT UP. BOND BETWEEN WYTHES IN BRICK AND BLOCK WALLS SHALL BE ACCOMPLISHED THROUGH THE USE OF METAL TIES OF SIMILAR DESIGN TO THE EXISTING TIES. FREQUENCY OF METAL TIES SHALL BE 16" OC VERTICAL X 16" OC HORIZONTAL TYPICALLY AND 8" OC VERTICAL X 8" OC HORIZONTAL ADJACENT TO HEADS, JAMBS, AND SILLS OF OPENINGS.

STRUCTURAL STEEL

1. STEEL MATERIALS SHALL CONFORM TO THE FOLLOWING MINIMUM REQUIREMENTS UNLESS NOTED OTHERWISE:
   - W-SHAPES — ASTM A992, MIN 50 KSI
   - HSS-SHAPES — ASTM A500, GRADE C, MIN 50 KSI
   - PIPES — ASTM A53, GRADE B, MIN 35 KSI
   - ALL OTHER — ASTM A36, MIN 36 KSI

2. CONNECTION MATERIAL SHALL CONFORM TO THE FOLLOWING MINIMUM REQUIREMENTS OR AS NEEDED FOR CONNECTION DESIGN:
   - ANGLES & PLATES — ASTM A36, MIN 36 KSI
   - WT-SHAPES — ASTM A992, MIN 50 KSI
   - BOLTS — ASTM F3125
   - NUTS — ASTM A563
   - WASHERS — ASTM F436
   - THREADED RODS — ASTM A36, MIN 36 KSI
   - ANCHOR RODS — ASTM F1554 WELDABLE, GRADE 55
   - WELD ELECTRODES — E70XX

3. ALL BOLTED CONNECTIONS ARE BEARING TYPE CONNECTIONS MADE WITH 3/4" DIAMETER HIGH-STRENGTH BOLTS IN 13/16" DIAMETER OPEN HOLES INSTALLED TO THE SNUG TIGHT CONDITION, UNLESS NOTED OTHERWISE.

4. ALL CONNECTIONS NOT SPECIFICALLY DETAILED, SHALL BE BEARING TYPE CONNECTIONS DESIGNED AND DETAILED BY THE FABRICATOR TO SUPPORT THE END REACTIONS NOTED ON THE DRAWINGS. SHEAR TAB CONNECTIONS ARE PERMISSIBLE FOR SECONDARY BEAMS, PRIMARY GIRDERS REQUIRE DOUBLE CLIP ANGLES, TYP.

5. SPLICES SHALL BE ALLOWED ONLY AT LOCATIONS SPECIFICALLY INDICATED ON THE STRUCTURAL DRAWINGS UNLESS APPROVED OTHERWISE BY THE STRUCTURAL ENGINEER OF RECORD.

6. DO NOT USE OVERSIZED OR SLOTTED HOLES FOR ANY CONNECTIONS UNLESS SPECIFICALLY INDICATED ON THE DRAWINGS OR APPROVED BY THE STRUCTURAL ENGINEER OF RECORD.

7. PROVIDE L4X4X1/4" SEATS AT COLUMN WEBS WHERE REQUIRED FOR SUPPORT OF ROOF AND FLOOR DECKS.

8. STEEL THAT MAY ACCUMULATE WATER SHALL HAVE DRAIN HOLES. ALL DRAIN PENETRATIONS THROUGH MAIN MEMBERS SHALL NOT EXCEED 1-INCH IN DIAMETER AND SHALL BE GROUND SMOOTH. THESE DRAINS MUST BE KEPT CLEAN AND OPEN.

9. SHOW ALL COPES, HOLES, OPENINGS, AND MODIFICATIONS REQUIRED IN STRUCTURAL STEEL MEMBERS FOR ERECTION OR THE WORK OF OTHER TRADES ON THE SHOP DRAWINGS.

10. ALL WELDING SHALL BE DONE BY CERTIFIED, LICENSED WELDERS AND SHALL BE IN CONFORMANCE WITH THE STRUCTURAL WELDING CODE OF THE AMERICAN WELDING SOCIETY ANSI/AWS D1.1, LATEST EDITION.

11. NO PENETRATIONS ARE PERMITTED THROUGH STRUCTURAL STEEL MEMBERS UNLESS INDICATED ON STRUCTURAL DRAWINGS OR APPROVED BY THE STRUCTURAL ENGINEER OF RECORD.

12. MILLED OR BUTT WELDED STIFFENERS SHALL BE PROVIDED ON GIRDERS SUPPORTING A COLUMN AND OVER ALL COLUMNS.

13. APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD SHALL BE MANDATORY FOR THE USE OF CUTTING TORCH IN THE FIELD.

14. ALL GROUT UNDER STEEL PLATES SHALL BE NON-SHRINK "PRE-MIX" TYPE AND SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI, TESTED IN ACCORDANCE WITH CONCRETE SPECIFICATIONS. USE NON-STAINING GROUT AT EXPOSED LOCATIONS. GROUT BENEATH COLUMN BASE PLATES SHALL BE INSTALLED AS NOTED IN "THE AISC CODE OF STANDARD PRACTICE" AFTER THE STEEL FRAMING ABOVE THE BASE PLATE IS PLUMB AND HELD IN PLACE WITH TEMPORARY GUYING, IF NECESSARY, AND PRIOR TO POURING ANY SUPPORTED SLABS ON METAL DECK THAT ARE SUPPORTED BY THE FRAME OR CONSTRUCTING ANY ENGAGED WALLS THAT WOULD PREVENT PROPER PLUMB OF THE FRAME FROM BEING ACHIEVED.

15. THE STEEL FABRICATOR MAY SUBSTITUTE HEAVIER SECTIONS IN PLACE OF THE SECTIONS SHOWN ON THE DRAWINGS TO ACHIEVE ECONOMY OF REPETITION, FOR AVAILABILITY, OR TO TAKE ADVANTAGE OF ROLLING MILL PRODUCTION SCHEDULES SO LONG AS THE CHANGES ARE MADE KNOWN TO THE ARCHITECT AND STRUCTURAL ENGINEER, AND ARE ACCEPTABLE TO BOTH.

16. ALL STRUCTURAL STEEL SHALL BE PAINTED WITH ONE SHOP-APPLIED COAT OF RUST INHIBITING PRIMER AFTER SURFACE PREPARATION BY THE SOCIETY FOR PROTECTIVE COATINGS (SSPC) SP3 "POWER TOOL CLEANING", UNLESS NOTED OTHERWISE. DO NOT PAINT PORTIONS OF STEEL MEMBERS THAT ARE TO RECEIVE SPRAY-ON FIREPROOFING, NOR SURFACES TO RECEIVE WELDED SHEAR STUDS. STEEL STRUCTURE THAT IS PERMANENTLY EXPOSED TO THE EXTERIOR SHALL BE HOT DIP GALVANIZED ACCORDING TO ASTM A123.

17. FOR MISCELLANEOUS STEEL CONSTRUCTION NOT SHOWN ON STRUCTURAL DRAWINGS, SEE ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS.

NEW METAL DECKING

1. ROOF DECK SHALL HAVE A PROTECTIVE ZINC COATING CONFORMING TO ASTM A653, GRADE 90. GAUGE AND DEPTH OF DECKING IS INDICATED ON THE FRAMING PLANS.

2. UNLESS OTHERWISE NOTED, ALL METAL DECK HAS BEEN DESIGNED TO BE CONTINUOUS OVER 3 SPANS MINIMUM, AND SHALL BEAR AT LEAST 2 INCHES ON STEEL SUPPORTS AND 4 INCHES ON OTHER SUPPORTS. FOR ONE OR TWO SPAN CONDITIONS, THE CONTRACTOR SHALL PROVIDE SHORING AS REQUIRED, OR FURNISH HIGHER GAGE DECK AS REQUIRED TO SUPPORT ALL THE APPLICABLE LOADS. CONTRACTOR SHALL SUBMIT ALTERNATE FOR APPROVAL.

3. DECK SHALL BE WELDED TO SUPPORTING STEEL AT ENDS OF UNITS AND AT ALL INTERMEDIATE SUPPORTS IN ACCORDANCE WITH "FACTORY MUTUAL" REQUIREMENTS AND THE MANUFACTURER'S RECOMMENDATIONS. ANCHOR DECK UNITS TO STEEL SUPPORTING MEMBER BY ARC SPOT PUDDLE WELDS OR APPROVED MECHANICAL FASTENERS.
   - ROOF DECK SIDE LAPS SHALL BE SCREWED AT 12" OC MAXIMUM WITH #10 SELF-DRILLING SCREWS.
   - TYPICALLY ROOF DECK SHALL BE ATTACHED TO SUPPORT STEEL WITH 3/4-INCH DIAMETER PUDDLE WELDS AT 12" OC SPACING ALONG ALL SUPPORTS EXCEPT 6-INCH OC SPACING MUST BE USED AT PERIMETER INCLUDING PERIMETER OF ROOF OPENINGS, RIDGES, VALLEY, AND ETC.

4. ISOLATED UNFRAMED OPENINGS SHALL BE SUITABLY REINFORCED BY METAL DECK CONTRACTOR. FOLLOW RECOMMENDATIONS GIVEN IN "DECK DAMAGE AND PENETRATIONS" BY RICHARD B. HEAGLER, PUBLISHED BY THE STEEL DECK INSTITUTE.

5. PROVIDE ALL ACCESSORIES INCLUDING, BUT NOT LIMITED TO: REINFORCING CHANNELS, STANDARD CLOSURES, CANT STRIPS, SUMP PANS, FINISH STRIPS, POUR STOPS, AND OTHER ACCESSORIES AS REQUIRED FOR A COMPLETE AND PROPER INSTALLATION, AND AS RECOMMENDED BY THE MANUFACTURER.

6. SHOP DRAWINGS SHALL INDICATE ALL INFORMATION NECESSARY FOR THE COMPLETE FABRICATION AND ERECTION OF METAL DECK.

STEEL JOISTS & JOIST GIRDERS

1. STEEL JOISTS AND/OR JOIST GIRDERS SHALL BE THE TYPE AND SIZE SHOWN ON THE DRAWINGS. SPECIAL JOISTS (SP) HAVE SPECIAL DESIGN REQUIREMENTS; REFER TO PLANS AND DETAILS FOR LOCATIONS AND LOADING DIAGRAMS.

2. PROVIDE SPECIAL SLOPED AND/OR SKEWED SEATS AS REQUIRED BY THE BUILDING DESIGN.

3. THE ENDS OF STEEL JOISTS SHALL EXTEND A MINIMUM DISTANCE OF 2 1/2 INCHES OVER STEEL SUPPORTS AND 4 INCHES OVER ALL OTHER SUPPORTS. THE ENDS SHALL BE FASTENED BY BOLTING OR WELDING.

4. NO CONSTRUCTION LOADS SHALL BE PLACED ON THE JOISTS BEFORE THEY ARE PERMANENTLY FASTENED TO SUPPORTS, AND ALL BRIDGING AND ANCHORS ARE COMPLETELY INSTALLED.

5. SUPPORT ROOFTOP UNITS AND OTHER SUSPENDED EQUIPMENT AND PIPING DIRECTLY FROM JOIST PANEL POINTS UNLESS TOP OR BOTTOM CHORD HAS BEEN SPECIFICALLY DESIGNED FOR LOADING OR ADDITIONAL REINFORCEMENT IS PROVIDED.

6. PROVIDE ALL JOISTS, BRIDGING, AND ACCESSORIES REQUIRED FOR A COMPLETE AND PROPER INSTALLATION, AND AS RECOMMENDED BY THE MANUFACTURER. ALL ENDS OF BRIDGING LINES SHALL TERMINATE AT STEEL BEAMS AND/OR MASONRY WALLS AND SHALL BE ANCHORED THERETO.

7. ALL JOISTS AND JOIST GIRDERS SHALL BE SHOP PAINTED WITH ONE COAT OF RUST INHIBITING PRIMER, UNLESS OTHERWISE NOTED.

COLD FORMED METAL FRAMING

1. FABRICATION AND ASSEMBLY OF COLD FORMED METAL FRAMING (CFMF) SHALL BE IN ACCORDANCE WITH AISI STANDARDS AND THE INTERNATIONAL BUILDING CODE, LATEST EDITIONS.

2. ALL METAL STUDS IN EXTERIOR WALLS, FASCIAS, AND SOFFITS SHALL BE 18 GAGE MINIMUM GALVANIZED STUDS, UNLESS OTHERWISE NOTED.

3. THE COLD-FORMED METAL FRAMING CONTRACTOR SHALL SUBMIT CALCULATIONS AND SHOP DRAWINGS FOR ALL METAL STUD WORK INCLUDING WALLS, FASCIAS, AND SOFFITS. THE CALCULATIONS AND DRAWINGS SHALL BE PREPARED UNDER THE DIRECT SUPERVISION OF A PE REGISTERED IN THE STATE OF THE PROJECT AND SHALL BE SEALED. THE CALCULATIONS SHALL TAKE INTO ACCOUNT THE EFFECTS OF OPENINGS AND SHALL SHOW REQUIRED REINFORCEMENT AT JAMBS, HEADS, AND SILLS. FASTENERS FOR METAL STUDS SHALL BE CALCULATED AND DETAILED ON THE SHOP DRAWINGS. THE STEEL STUD CONTRACTOR SHALL DESIGN ALL STEEL STUDS FOR THE APPROPRIATE LOADS AND FOR A MAXIMUM DEFLECTION DUE TO LATERAL LOADS OF L/600 SPAN AT WALLS WITH BRICK VENEER AND L/360 SPAN FOR WALLS WITH METAL SKIN. FABRICATION SHALL NOT PROCEED UNTIL ARCHITECT-APPROVED SHOP DRAWINGS HAVE BEEN RECEIVED BY THE STEEL STUD CONTRACTOR.

4. FRAMING ROLLED FROM STEEL 18-GAGE AND LIGHTER SHALL CONFORM TO ASTM A1011, LATEST EDITION, COMMERCIAL GRADE, WITH A MINIMUM YIELD STRESS OF 33 KSI.

5. FRAMING ROLLED FROM STEEL 16-GAGE AND HEAVIER SHALL CONFORM TO ASTM A1011, LATEST EDITION, COMMERCIAL GRADE, WITH A MINIMUM YIELD STRESS OF 50 KSI.

6. SCREW FASTENERS FOR STEEL CONNECTIONS SHALL BE IN COMPLIANCE WITH ASTM C 1513 OR APPROVED ALTERNATIVE. USE OF SCREW SIZE LARGER THAN SPECIFIED IS PERMITTED AS LONG AS SPACING AND EDGE DISTANCE REQUIREMENTS ARE MET.

7. LOAD BEARING WALL STUDS MUST HAVE SQUARE CUT ENDS AND MUST SIT TIGHT AGAINST THE TRACK WITH A MAXIMUM GAP TOLERANCE OF 1/8 INCH BETWEEN THE END OF THE STUD AND THE WEB OF THE TRACK. LOAD BEARING WALL STUDS SHALL ENGAGE TRACK FLANGES AND BE PROVIDED WITH A MINIMUM #10 SCREW THROUGH EACH FLANGE.

8. PROVIDE ALL ACCESSORIES INCLUDING, BUT NOT NECESSARILY LIMITED TO, TRACKS, CLIPS, WEB STIFFENERS, ANCHORS, FASTENING DEVICES, RESILIENT CLIPS, AND OTHER ACCESSORIES REQUIRED FOR A COMPLETE AND PROPER INSTALLATION, AND AS RECOMMENDED BY THE MANUFACTURER FOR THE STEEL MEMBERS USED.

9. COLD-FORMED METAL FRAMING SHALL HAVE THE REQUIRED BRIDGING AND ACCESSORIES PER THE MANUFACTURER'S SPECIFICATIONS.

10. PROVIDE TEMPORARY BRACING AND PRECAUTIONS NECESSARY TO WITHSTAND ALL CONSTRUCTION AND/OR WIND LOADS UNTIL ALL FIELD CONNECTIONS ARE COMPLETED AND SHEAR WALLS OR DECKS ARE IN PLACE.

11. ALL FRAMING MEMBERS SHALL RECEIVE STANDARD SHOP PAINT, UNLESS NOTED OTHERWISE.

FIELD DRILLED MECHANICAL ANCHORS

1. BASIS OF DESIGN FOR FIELD DRILLED MECHANICAL ANCHORS IN CONCRETE AND SOLID GROUTED MASONRY SHALL BE HILTI KWIK BOLT TZ2 ANCHORS AS MANUFACTURED BY HILTI, OR EQUIVALENT PRODUCT. FOR SUBSTITUTION PURPOSES, SIGNED AND SEALED CALCULATIONS SHALL BE PROVIDED FOR REVIEW, INDICATING THE SUBSTITUTED ANCHOR MEETS THE CAPACITY REQUIREMENTS OF THE DETAILED ANCHOR.

2. ANCHOR CAPACITY IS DEPENDENT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE OR MASONRY. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.

3. USE ONLY CODE-APPROVED ANCHORS WITH VALID EVALUATION REPORT FOR USE IN THE BASE MATERIAL SHOWN ON THE CONSTRUCTION DOCUMENTS. SUBMIT EVALUATION REPORT TO STRUCTURAL ENGINEER OF RECORD AND SPECIAL INSPECTION AGENT FOR APPROVAL. DO NOT INSTALL ANCHORS UNTIL SUBMITTAL IS RETURNED "REVIEWED WITHOUT COMMENT."

4. ONLY ONE LENGTH ANCHOR SHALL BE PRESENT ON THE JOB SITE FOR A GIVEN ANCHOR DIAMETER, UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS.

5. ALL FIELD INSTALLED MECHANICAL ANCHORS SHALL CONFORM TO AC-193. INSTALLER OF FIELD INSTALLED MECHANICAL ANCHORS SHALL BE TRAINED BY ANCHOR MANUFACTURER TO ENSURE PROPER INSTALLATION REQUIREMENTS SUCH AS DRILLING METHODS, HOLE CLEANING, AND INSTALLATION TORQUE.

6. MECHANICAL ANCHORS OF THE DIAMETER AND EMBEDMENT SHOWN ON THE DRAWINGS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNDER THE CONTINUOUS SUPERVISION OF AN INDEPENDENT TESTING AGENCY. WHERE THE PROVISIONS OF THE ABOVE REFERENCED DOCUMENTS ARE IN CONFLICT, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. AT LOCATIONS WHERE ANCHORAGE IS NOT SPECIFIED, CONSULT STRUCTURAL ENGINEER OF RECORD.

7. CLEAN EXISTING CONCRETE SURFACE TO SOLID STRUCTURAL CONCRETE. GRIND SMOOTH FOR FULL STEEL CONTACT AND TO PREVENT GAPS BETWEEN STEEL AND CONCRETE. ALTERNATIVELY, PROVIDE NON-SHRINK GROUT IN ALL VOIDS BETWEEN STEEL AND BASE MATERIAL. FOREIGN MATERIAL SHALL NOT BE PLACED IN THE HOLES THAT RECEIVE MECHANICAL ANCHORS. ALL ABANDONED HOLES DRILLED IN CONCRETE SHALL BE COMPLETELY FILLED WITH STRUCTURAL GRADE EPOXY.

8. THE CONTRACTOR SHALL CREATE A TEMPLATE AT EACH MECHANICAL ANCHOR CONNECTION LOCATION **PRIOR** TO FABRICATING HOLES IN CONNECTING PLATES OR ROLLED SHAPES. TEMPLATES SHALL BE MADE BY FIRST LOCATING EXISTING REINFORCING STEEL USING NON-DESTRUCTIVE TESTING EQUIPMENT, AND THEN DRILLING ANCHOR HOLES SUCH THAT NO CONFLICT EXISTS WITH THE EXISTING REINFORCING. ANCHOR LOCATIONS IN THE FIELD MAY BE RELOCATED A MAXIMUM OF 1 1/2 INCHES FROM THE DIMENSIONS SHOWN ON THE DRAWINGS TO AVOID CONFLICTS WITH THE EXISTING REINFORCING STEEL. HOWEVER, DO NOT EXCEED MINIMUM ANCHOR SPACINGS OR EDGE DISTANCES MANUFACTURER'S REQUIREMENTS.

9. MECHANICAL ANCHORS SHALL BE INSTALLED PERPENDICULAR TO THE FACE OF THE SURFACE BEING DRILLED. THE MAXIMUM TOLERANCE FOR DEVIATION FROM PERPENDICULAR SHALL BE 6 DEGREES. ALL MECHANICAL ANCHORS INSTALLED OUTSIDE OF THE SPECIFIED TOLERANCE SHALL BE CONSIDERED UNACCEPTABLE. USE OF DIAMOND CORE BIT WITH ROUGHENING TOOL FOR ANCHOR HOLES REQUIRES APPROVAL FROM STRUCTURAL ENGINEER OF RECORD PRIOR TO DRILLING.

10. HOLES IN CONNECTION PLATES SHALL BE NO MORE THAN 3/16 INCH LARGER THAN THE MECHANICAL ANCHOR ROD DIAMETER. IF LARGER DIAMETER HOLES ARE USED FOR ERECTION PURPOSES, THE CONTRACTOR MUST PROVIDE PLATE WASHERS WITH HOLES NO MORE THAN 1/16 INCH LARGER THAN THE ANCHOR. PLATE WASHERS MUST BE WELDED TO THE CONNECTION PLATE TO TRANSFER THE LOAD.

FIELD DRILLED ADHESIVE ANCHORS

1. BASIS OF DESIGN FOR FIELD DRILLED ADHESIVE ANCHORS AND REBAR IN CONCRETE SHALL BE HILTI HIT-HY 200 V3 AS MANUFACTURED BY HILTI, OR EQUIVALENT PRODUCT. BASIS OF DESIGN FOR FIELD DRILLED ADHESIVE ANCHORS AND REBAR IN MASONRY SHALL BE HILTI HIT-HY 270 AS MANUFACTURED BY HILTI, OR EQUIVALENT PRODUCT. FOR HOLLOW OR MULTI-WYTHE MASONRY, PROVIDE APPROPRIATELY SIZED SCREEN TUBE PER INSTALLATION INSTRUCTIONS. FOR SUBSTITUTION PURPOSES, SIGNED AND SEALED CALCULATIONS SHALL BE PROVIDED FOR REVIEW, INDICATING THE SUBSTITUTED ANCHOR MEETS THE CAPACITY REQUIREMENTS OF THE DETAILED ANCHOR.

2. ANCHOR CAPACITY IS DEPENDENT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE OR MASONRY. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.

3. USE ONLY CODE-APPROVED ANCHORS WITH VALID EVALUATION REPORT FOR USE IN THE BASE MATERIAL SHOWN ON THE CONSTRUCTION DOCUMENTS. SUBMIT EVALUATION REPORT TO STRUCTURAL ENGINEER OF RECORD AND SPECIAL INSPECTION AGENT FOR APPROVAL. DO NOT INSTALL ANCHORS UNTIL SUBMITTAL IS RETURNED "REVIEWED WITHOUT COMMENT."

4. ONLY ONE LENGTH ANCHOR SHALL BE PRESENT ON THE JOB SITE FOR A GIVEN ANCHOR DIAMETER, UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS.

5. ALL FIELD INSTALLED ADHESIVE ANCHORS SHALL CONFORM TO AC-308. INSTALLER OF FIELD INSTALLED ADHESIVE ANCHORS SHALL BE TRAINED BY ANCHOR MANUFACTURER TO ENSURE PROPER INSTALLATION REQUIREMENTS SUCH AS HOLE CLEANING, HORIZONTAL AND OVERHEAD APPLICATIONS, EMBEDMENT DEPTHS GREATER THAN 10 INCHES, AND WATER FILLED HOLES.

6. ADHESIVE ANCHORS OF THE DIAMETER AND EMBEDMENT SHOWN ON THE DRAWINGS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNDER THE CONTINUOUS SUPERVISION OF AN INDEPENDENT TESTING AGENCY. WHERE THE PROVISIONS OF THE ABOVE REFERENCED DOCUMENTS ARE IN CONFLICT, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. AT LOCATIONS WHERE ANCHORAGE IS NOT SPECIFIED, CONSULT STRUCTURAL ENGINEER OF RECORD.

7. CLEAN EXISTING CONCRETE SURFACE TO SOLID STRUCTURAL CONCRETE. GRIND SMOOTH FOR FULL STEEL CONTACT AND TO PREVENT GAPS BETWEEN STEEL AND CONCRETE. ALTERNATIVELY, PROVIDE NON-SHRINK GROUT IN ALL VOIDS BETWEEN STEEL AND BASE MATERIAL. FOREIGN MATERIAL SHALL NOT BE PLACED IN THE HOLES THAT RECEIVE ADHESIVE ANCHORS. ALL ABANDONED HOLES DRILLED IN CONCRETE SHALL BE COMPLETELY FILLED WITH STRUCTURAL GRADE EPOXY.

8. THE CONTRACTOR SHALL CREATE A TEMPLATE AT EACH ADHESIVE ANCHOR CONNECTION LOCATION **PRIOR** TO FABRICATING HOLES IN CONNECTING PLATES OR ROLLED SHAPES. TEMPLATES SHALL BE MADE BY FIRST LOCATING EXISTING REINFORCING STEEL USING NON-DESTRUCTIVE TESTING EQUIPMENT, AND THEN DRILLING ANCHOR HOLES SUCH THAT NO CONFLICT EXISTS WITH THE EXISTING REINFORCING. ANCHOR LOCATIONS IN THE FIELD MAY BE RELOCATED A MAXIMUM OF 1 1/2 INCHES FROM THE DIMENSIONS SHOWN ON THE DRAWINGS TO AVOID CONFLICTS WITH THE EXISTING REINFORCING STEEL. HOWEVER, DO NOT EXCEED MINIMUM ANCHOR SPACINGS OR EDGE DISTANCES PER MANUFACTURER'S REQUIREMENTS.

9. ADHESIVE ANCHORS SHALL BE INSTALLED PERPENDICULAR TO THE FACE OF THE SURFACE BEING DRILLED. THE MAXIMUM TOLERANCE FOR DEVIATION FROM PERPENDICULAR SHALL BE 6 DEGREES. ALL ADHESIVE ANCHORS INSTALLED OUTSIDE OF THE SPECIFIED TOLERANCE SHALL BE CONSIDERED UNACCEPTABLE. USE OF DIAMOND CORE BIT WITH ROUGHENING TOOL FOR ANCHOR HOLES REQUIRES APPROVAL FROM STRUCTURAL ENGINEER OF RECORD PRIOR TO DRILLING.

10. HOLES IN CONNECTION PLATES SHALL BE NO MORE THAN 3/16 INCH LARGER THAN THE ADHESIVE ANCHOR ROD DIAMETER. IF LARGER DIAMETER HOLES ARE USED FOR ERECTION PURPOSES, THE CONTRACTOR MUST PROVIDE PLATE WASHERS WITH HOLES NO MORE THAN 1/16 INCH LARGER THAN THE ANCHOR. PLATE WASHERS MUST BE WELDED TO THE CONNECTION PLATE TO TRANSFER THE LOAD. WELDING MUST TAKE PLACE AFTER HOLES ARE DRILLED, BUT PRIOR TO ADHESIVE INSTALLATION TO AVOID BURNING OR MELTING THE ADHESIVE.

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Design Development	08/18/23
Bid and Construction	01/26/24

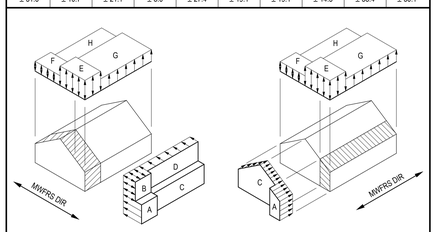
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
STRUCTURAL NOTES

SHEET NO.
S0.01

MAIN WIND FORCE RESISTING SYSTEM (psf) FLAT ROOFS									
HORIZONTAL PRESSURES				VERTICAL PRESSURES				OVERHANG PRESSURES	
A	B	C	D	E	F	G	H	Eoh	Goh
± 22.8	± 11.9	± 16.0	± 8.0	± 27.4	± 15.6	± 19.1	± 12.1	± 38.4	± 30.1

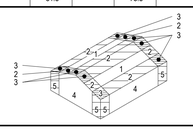
MAIN WIND FORCE RESISTING SYSTEM (psf) SLOPED ROOFS									
HORIZONTAL PRESSURES				VERTICAL PRESSURES				OVERHANG PRESSURES	
A	B	C	D	E	F	G	H	Eoh	Goh
± 31.6	± 10.7	± 21.1	± 8.0	± 27.4	± 19.1	± 19.1	± 14.5	± 38.4	± 30.1

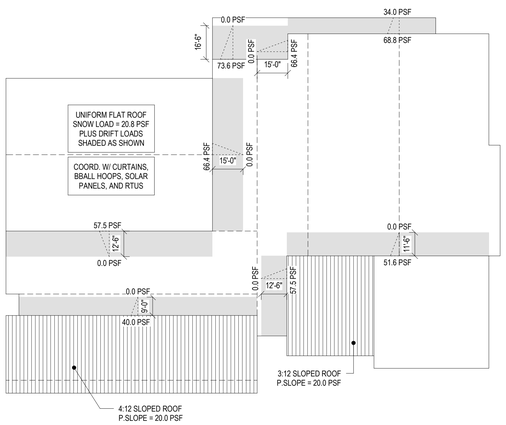


COMPONENTS AND CLADDING

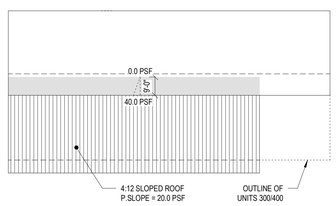
LOADS FOR FLAT ROOFS (psf)								
ZONE	10 SF		20 SF		50 SF		100 SF	
1	16.0	-25.9	16.0	-25.2	16.0	-24.4	16.0	-23.7
2	16.0	-43.5	16.0	-38.8	16.0	-32.7	16.0	-28.1
3	16.0	-65.4	16.0	-54.2	16.0	-39.3	16.0	-28.1
4	25.9	-28.1	24.7	-26.9	23.2	-25.4	22.0	-24.2
5	25.9	-34.7	24.7	-32.4	23.2	-29.3	22.0	-26.9
2 ROH	-	-37.5	-	-36.8	-	-35.9	-	-35.3
3 ROH	-	-61.7	-	-48.4	-	-30.9	-	-17.6

LOADS FOR SLOPED ROOFS (psf)								
ZONE	10 SF		20 SF		50 SF		100 SF	
1	16.0	-23.7	16.0	-23.0	16.0	-22.2	16.0	-21.5
2	16.0	-41.3	16.0	-38.0	16.0	-33.6	16.0	-30.3
3	16.0	-61.0	16.0	-57.1	16.0	-51.8	16.0	-47.9
4	25.9	-28.1	24.7	-26.9	23.2	-25.4	22.0	-24.2
5	25.9	-34.7	24.7	-32.4	23.2	-29.3	22.0	-26.9
2 ROH	-	-48.5	-	-48.5	-	-48.5	-	-48.5
3 ROH	-	-81.5	-	-73.5	-	-63.0	-	-55.1





1 S0.02 ROOF SNOW LOAD DIAGRAM UNIT 100
Scale: 1" = 30'-0"



2 S0.02 ROOF SNOW LOAD DIAGRAM
UNIT 200, 300, 400
Scale: 1" = 30'-0"

MASONRY CONSTRUCTION REQUIREMENTS PER TMS 602/ACI 530.1/ASCE 6

TMS 602 - TABLE 3 - MINIMUM VERIFICATION REQUIREMENTS

Minimum Verification	LVL 1	LVL 2	LVL 3
Prior to construction, verification of compliance of submittals	R	R	R
Prior to construction, verification of f'm and f'AAC, except where specifically exempted by the Code	NR	R	R
During construction, verification of Slump flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to the project site	NR	R	R
During construction, verification of f'm and f'AAC for every 5,000 sq. ft.	NR	NR	R
During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	NR	NR	R

TMS 602 - TABLE 4 - MINIMUM SPECIAL INSPECTION REQUIREMENTS

Minimum Verification	LVL 1	LVL 2	LVL 3
As masonry construction begins, verify that the following are in compliance:			
Proportions of site-prepared mortar	NR	P	P
Grade, type, and size of reinforcement, connectors, anchor bolts	NR	P	P
Properties of thin-bed mortar for AAC masonry	NR	P	C
Prior to grouting, verify that the following are in compliance:			
Grout space	NR	P	C
Placement of reinforcement, connectors, and anchor bolts	NR	P	C
Proportions of site-prepared grout	NR	P	P
Verify compliance of the following during construction:			
Materials and procedures with the approved submittals	NR	P	P
Placement of masonry units and mortar joint construction	NR	P	P
Size and location of structural members	NR	P	P
Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	NR	P	C
Welding of reinforcement	NR	C	C
Preparation, construction, and protection of masonry during cold weather (temperature below 40F) or hot weather (temperature above 90F)	NR	P	P
Placement of AAC masonry units and construction of thin-bed mortar joints	NR	C/P	C
Observe preparation of grout specimens, mortar specimens, and/or prisms	NR	P	C

MICHIGAN BUILDING CODE 2015

TABLE 1705.2.3 - SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS

TYPE	CONTINUOUS	PERIODIC
Installation of open-web steel joists and joist girders		
a. End connections - welding or bolted	--	X
b. Bridging - horizontal or diagonal	--	
1. Standard bridging	--	X
2. Bridging that differs from the SJI specifications listed in Section 2207.1		X

TABLE 1705.3 - REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS	PERIODIC
Inspect reinforcement, including prestressing tendons, and verify placement.	--	X
Reinforcing bar welding:		
Verify weldability of reinforcing bars other than ASTM A706	--	X
Inspect single-pass fillet welds, maximum 5/16"		X
Inspect all other welds	X	
Inspect anchors cast in concrete	--	X
Inspect anchors post-installed in hardened concrete members		
Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.	X	
Mechanical anchors and adhesive anchors not defined above		X
Verify use of required design mix	--	X
Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	X	--
Inspect concrete and shotcrete placement for proper application techniques	X	--
Verify maintenance of specified curing temperature and techniques	--	X
Inspect prestressed concrete for:		
Application of prestressing forces	X	--
Grouting of bonded prestressing tendons	X	--
Inspect erection of precast concrete members	--	X
Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structure slabs	--	X
Inspect formwork for shape, location, and dimensions of the concrete member being formed	--	X

TABLE 1705.6 - REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS	PERIODIC
Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	--	X
Verify excavations are extended to proper depth and have reached proper material.	--	X
Perform classification and testing of compacted fill materials	--	X
Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill.	X	--
Prior to placement of compacted fill, observe subgrade and verify that the site has been prepared properly.	--	X

STRUCTURAL STEEL REQUIREMENTS PER:
STEEL DECK INSTITUTE QUALITY CONTROL AND QUALITY ASSURANCE

TABLE 1.1 - INSPECTION OR EXECUTION TASKS PRIOR TO DECK PLACEMENT

TASK	QC	QA
Verify compliance of materials (deck and all accessories) with construction documents, including profiles, material properties, and base metal thickness	Perform	Perform
Document acceptance or rejection of deck and deck accessories	Perform	Perform

TABLE 1.2 - INSPECTION OR EXECUTION TASKS AFTER DECK PLACEMENT

TASK	QC	QA
Verify compliance of deck and all accessories installation with const. docs	Perform	Perform
Verify deck materials are represented by the mill certifications that comply with the construction documents	N/A	Perform
Document acceptance or rejection of installation of deck and accessories	Perform	Perform

TABLE 1.3 - INSPECTION OR EXECUTION TASKS PRIOR TO DECK WELDING

TASK	QC	QA
Welding procedure specifications (WSP) available	Observe	Observe
Manufacturer certifications for welding consumables available	Observe	Observe
Material identification (type/grade)	Observe	Observe
Check welding equipment	Observe	Observe

TABLE 1.4 - INSPECTION OR EXECUTION TASKS DURING DECK WELDING

TASK	QC	QA
Use of qualified welders	Observe	Observe
Control and handling of welding consumables	Observe	Observe
Environmental conditions (wind speed, moisture, temperature)	Observe	Observe
WSP followed	Observe	Observe

TABLE 1.5 - INSPECTION OR EXECUTION TASKS AFTER DECK WELDING

TASK	QC	QA
Verify size and location of welds, including support, sidelap, perimeter welds	Perform	Perform
Welds meet visual appearance criteria	Perform	Perform
Verify repair activities	Perform	Perform
Document acceptance or rejection of welds	Perform	Perform

TABLE 1.6 - INSPECTION OR EXECUTION TASKS PRIOR TO MECHANICAL FASTENING

TASK	QC	QA
Manufacturer installation instructions available for mechanical fasteners	Observe	Observe
Proper tools available for fastener installation	Observe	Observe
Proper storage for mechanical fasteners	Observe	Observe

TABLE 1.7 - INSPECTION OR EXECUTION TASKS DURING MECHANICAL FASTENING

TASK	QC	QA
Fasteners are positioned as required	Observe	Observe
Fasteners are installed in accordance with manufacturer's instructions	Observe	Observe

TABLE 1.8 - INSPECTION OR EXECUTION TASKS AFTER MECHANICAL FASTENING

TASK	QC	QA
Check spacing, type, and installation of support fasteners	Perform	Perform
Check spacing, type, and installation of sidelap fasteners	Perform	Perform
Check spacing, type, and installation of perimeter fasteners	Perform	Perform
Verify repair activities	Perform	Perform
Document acceptance or rejection of mechanical fasteners	Perform	Perform

STRUCTURAL STEEL REQUIREMENTS PER:
AISC 360 - CHAPTER N - QUALITY CONTROL AND QUALITY ASSURANCE

MINIMUM REQUIREMENTS

PER IBC 2015 1705.2.1 STRUCTURAL STEEL:
SPECIAL INSPECTIONS AND NONDESTRUCTIVE TESTING OF STEEL ELEMENTS IN BUILDINGS, STRUCTURES, AND PORTIONS THEREOF SHALL BE IN ACCORDANCE WITH THE QUALITY ASSURANCE INSPECTION REQUIREMENTS OF AISC 360

QC	QUALITY CONTROL	O	THE INSPECTOR SHALL OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
QA	QUALITY ASSURANCE	P	THESE TASKS SHALL BE PERFORMED FOR EACH WELDED JOINT (OR BOLTED CONNECTION)

TABLE N5.4-1 - INSPECTION TASKS PRIOR TO WELDING

TASK	QC	QA
Welding qualification records and continuity records	P	O
Welding procedure specifications (WPS) available	P	P
Manufacturer certifications for welding consumables available	P	P
Material identification (type/grade)	O	O
Material identification system	O	O
Fit-up of groove welds (including joint geometry): • Joint penetrations • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)	O	O
Configuration and finish of access holes	O	O
Fit-up of fillet welds: • Dimensions (alignment, gaps at root) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location)	O	O
Check welding equipment	O	--

TABLE N5.4-2 - INSPECTION TASKS DURING WELDING

TASK	QC	QA
Control and handling of welding consumables: • Packaging • Exposure Control	O	O
No welding over cracked tack welds	O	O
Environmental conditions • Wind speed within limits • Precipitation and temperature	O	O
WPS followed: • Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type/flow rate • Preheat applied • Interpass temperature maintained (min/max) • Proper position (F, V, H, OH)	O	O
Welding techniques: • Interpass and final cleaning • Each pass within profile limitation • Each pass meets quality requirements	O	O
Placement and installation of steel headed stud anchors	P	P

TABLE N5.4-3 - INSPECTION TASKS AFTER WELDING

TASK	QC	QA
Welds cleaned	O	O
Size, length, and location of welds	P	P
Welds meet visual acceptance criteria: • Crack prohibition, weld/base-metal fusion, crater cross section • Weld profiles, weld size, undercut	P	P
Arc strikes	P	P
k-area	P	P
Weld access holes in rolled heavy shapes and built-up heavy shapes	P	P
Backing removed and weld tabs removed (if required)	P	P
Repair activities	P	P
Document acceptance or rejection of welded joint or member	P	P
No prohibited welds have been added without the approval of the EOR	O	O

TABLE N5.6-1 - INSPECTION TASKS PRIOR TO BOLTING

TASK	QC	QA
Manufacturer's certifications available for fastener materials	O	P
Fasteners marked in accordance with ASTM requirements	O	O
Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	O	O
Correct bolting procedure selected for joint detail	O	O
Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	O	O
Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used	P	O
Proper storage provided for bolts, nuts, washers, and other fastener components	O	O

TABLE N5.6-2 - INSPECTION TASKS DURING BOLTING

Fastener assemblies placed in all holes and washers and nuts are positioned as required	O	O
Joint brought to the snug-tight condition prior to pretensioning operation	O	O
Fastener component not turned by the wrench prevented from rotating	O	O
Fasteners are pretensioned in accordance with RSCS Specification, progressing systematically from the rigid point toward the free edges	O	O

TABLE N5.6-3 - INSPECTION TASKS AFTER BOLTING

Document acceptance or rejection of bolted connections	P	P

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

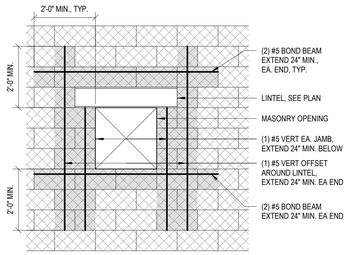
ISSUANCES	DATE
Design Development	08/18/23
Bid and Construction	01/26/24

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER

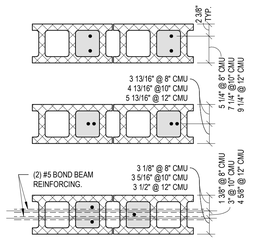
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
SPECIAL INSPECTIONS & LOADINGS

SHEET NO.
S0.02



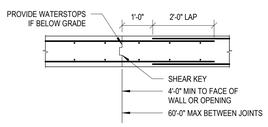
23 REINFORCING AROUND CMU OPENING
S0.03 Not to Scale



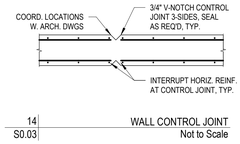
LAP SPLICES WILL BE REQUIRED FOR CONSTRUCTABILITY BUT ARE NOT SHOWN FOR CLARITY. LAPS IN VERTICAL BARS CENTERED IN WALL AT #5 BARS SHALL BE 30" IN LENGTH. LAPS IN VERTICAL BARS AT #4 BARS SHALL BE IN 24" IN LENGTH. LAP SPLICES IN VERTICAL BARS ARE TO BE MADE BY PLACING BARS SIDE BY SIDE WITHIN CORES SO DISTANCE FROM FACE OF CMU TO CENTER OF BAR IS MAINTAINED.

BOND BEAM BARS ARE TO BE CONTINUOUS WITH CORNER BARS LAPPED 24" MINIMUM.

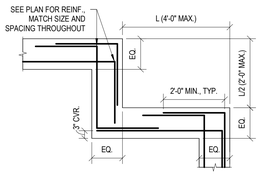
18 TYPICAL CMU WALL REINFORCING
S0.03 Not to Scale



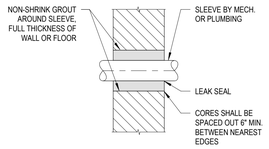
13 WALL CONSTRUCTION JOINT
S0.03 Not to Scale



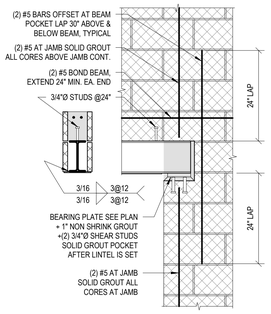
14 WALL CONTROL JOINT
S0.03 Not to Scale



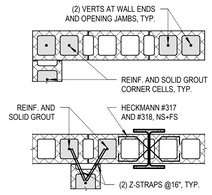
7 STEPPED FOUNDATION DETAIL
S0.03 Not to Scale



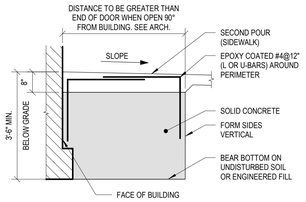
1 CORING AND SLEEVING IN EXISTING CONCRETE
S0.03 Not to Scale



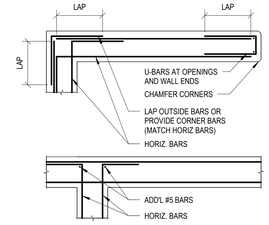
24 TYPICAL STEEL LINTEL BEARING
S0.03 Not to Scale



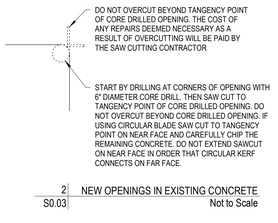
19 TYPICAL CMU WALL AND CORNER REINFORCING
S0.03 Not to Scale



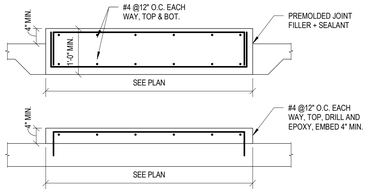
15 FROST-PROOF ENTRY SLAB
S0.03 Not to Scale



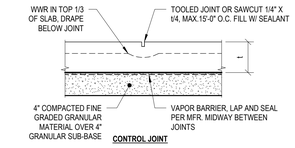
8 TYPICAL WALL AND CORNER REINFORCING
S0.03 Not to Scale



2 NEW OPENINGS IN EXISTING CONCRETE
S0.03 Not to Scale

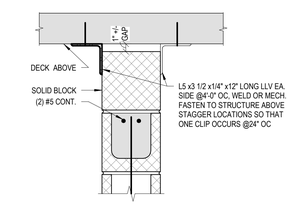


9 CONCRETE MECHANICAL PAD
S0.03 Not to Scale

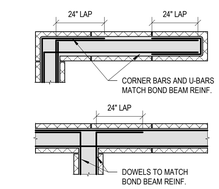


CONTROL JOINT

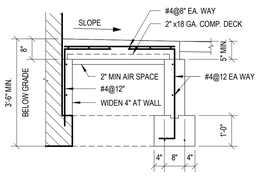
- PURPOSE OF SLAB ON GRADE JOINTING IS TO BREAK THE SLAB POURS INTO SIZES THAT ARE MANAGEABLE FOR FINISHING AND TO LIMIT TOTAL SHRINKAGE.
- PLACE CONSTRUCTION JOINTS SUCH THAT THE MAXIMUM SLAB POUR SIZE IS LIMITED TO 60'-0" x 60'-0".
- SLAB POURS SHALL BE SQUARE IF POSSIBLE, BUT IN NO CASE SHALL THEY BE GREATER THAN TWICE AS LONG AS THEY ARE WIDE.
- CONTROL JOINTS SHALL SUBDIVIDE A SLAB POUR INTO APPROX. 15'-0" x 15'-0" OR SMALLER AREAS.
- JOINTS SHALL BE PLACED WHERE POSSIBLE TO ALIGN WITH MAIN COLUMN LINES AND TO ELIMINATE RE-ENTRANT CORNERS IN THE SLAB.
- PROVIDE SLAB JOINT PATTERN AS SHOWN ON THE DRAWINGS, OR IF NOT SHOWN, CONTRACTOR SHALL SUPPLY A PROPOSED JOINT LAYOUT PATTER TO THE ARCHITECT FOR APPROVAL.



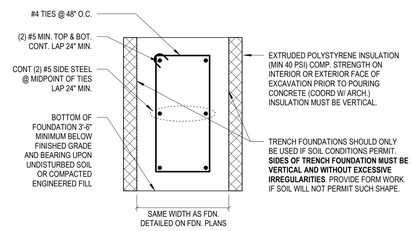
25 INTERIOR CMU PARTITION
S0.03 Not to Scale



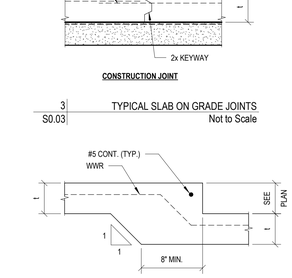
20 TYPICAL BOND BEAM REINFORCING
S0.03 Not to Scale



16 SUPPORTED ENTRY SLAB
S0.03 Not to Scale

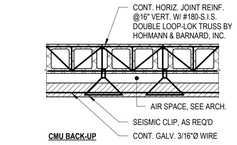


10 TRENCH FOUNDATION
S0.03 Not to Scale



4 DEPRESSION IN SLAB ON GRADE
S0.03 Not to Scale

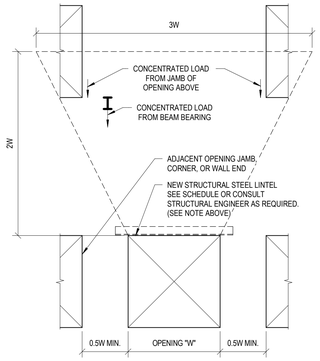
21 TYPICAL MASONRY VENEER REINFORCING
S0.03 Not to Scale



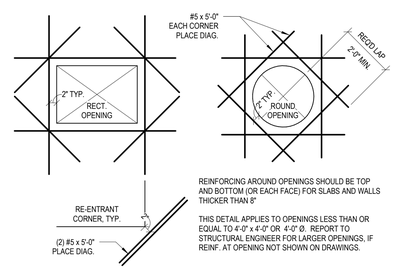
OPENING WIDTH "W"	SIZE OF LINTEL TO BE USED FOR EA. 4" OF WALL THICKNESS	MIN. BRG.
< 8"	NO LINTEL REQUIRED	--
8" TO 3'-0"	L3 1/2" x 3 1/2" x 1/4"	8"
3'-0" TO 3'-6"	L5" x 3 1/2" x 1/4" LLV	8"
3'-6" TO 5'-0"	L6" x 3 1/2" x 5/16" LLV	8"
5'-0" TO 6'-0"	L6" x 3 1/2" x 3/8" LLV	12"
> 6'-0"	CONSULT STRUCTURAL	

SELECT LINTEL FROM SCHEDULE ABOVE IF **BOTH** CONDITIONS BELOW ARE MET. IF EITHER CONDITION IS NOT MET, CONSULT THE PROJECT STRUCTURAL ENGINEER FOR LINTEL SIZE, BEARING, AND DETAIL UON

CONDITION A: NO CONCENTRATED LOADS FROM BEAM BEARING OR MASONRY JAMBS FALL WITHIN AN AREA 3W HORIZONTAL BY 2W VERTICAL
CONDITION B: THE DISTANCE TO THE CLOSEST ADJACENT OPENING, JAMB, CORNER, OR WALL END IS GREATER THAN 0.5W



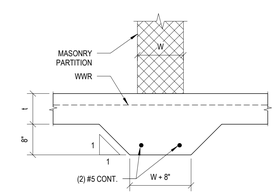
17 TYPICAL STEEL LINTEL SCHEDULE
S0.03 Not to Scale



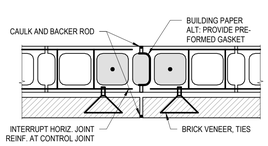
REINFORCING AROUND OPENINGS SHOULD BE TOP AND BOTTOM (OR EACH FACE) FOR SLABS AND WALLS THICKER THAN 8"

THIS DETAIL APPLIES TO OPENINGS LESS THAN OR EQUAL TO 4'-0" x 4'-0" OR 4'-0" Ø. REPORT TO STRUCTURAL ENGINEER FOR LARGER OPENINGS, IF REINF. AT OPENING NOT SHOWN ON DRAWINGS.

11 REINFORCING AT CONCRETE OPENINGS
S0.03 Not to Scale

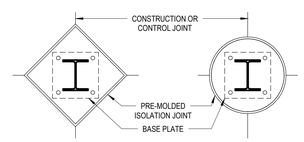


5 THICKENED SLAB UNDER MASONRY PARTITION WALL
S0.03 Not to Scale

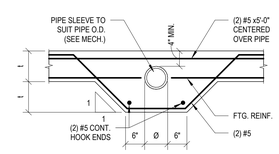


LOCATE JOINTS 24'-0" OC MAX SPACING UON. BRICK CONTROL JOINTS MAY BE OFFSET FROM CMU CONTROL JOINTS IF BRICK TIES PERMIT HORIZ. MOVEMENT PARALLEL TO THE PLANE OF THE WALL. LOCATE WHERE STRESS CONCENTRATIONS OCCUR, SUCH AS CHANGES IN WALL HEIGHT AND ADJACENT TO LARGE WALL OPENINGS, ETC.

22 MASONRY WALL CONTROL JOINT
S0.03 Not to Scale



12 COLUMN ISOLATION JOINTS
S0.03 Not to Scale



6 PIPE THROUGH FOUNDATION
S0.03 Not to Scale

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER

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Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
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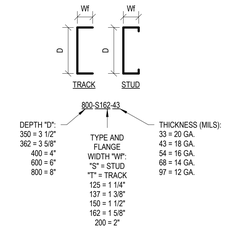
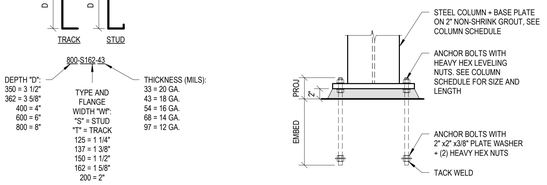
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
TYPICAL DETAILS

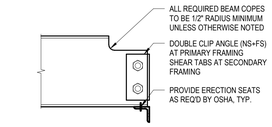
SHEET NO.
S0.03



11 S0.04 CFMF DESIGNATIONS
Not to Scale

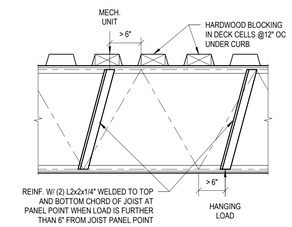


7 S0.04 TYPICAL ANCHOR ROD DETAIL
Not to Scale

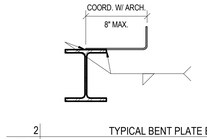


1 S0.04 TYPICAL BEAM COPES
Not to Scale

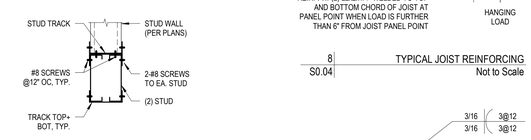
12 S0.04 TYPICAL CFMF JOIST BEARING
Not to Scale



8 S0.04 TYPICAL JOIST REINFORCING
Not to Scale

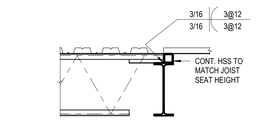


2 S0.04 TYPICAL BENT PLATE EDGE
Not to Scale

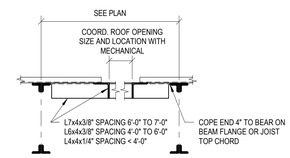


3 S0.04 METAL DECK SUPPORT AT COLUMN
Not to Scale

13 S0.04 TYPICAL CFMF BOX HEADERS
Not to Scale

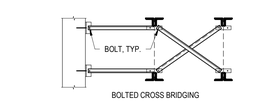


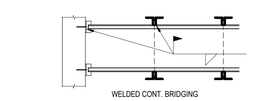
9 S0.04 CHANGE IN DECK DIRECTION
Not to Scale



4 S0.04 ANGLE FRAME FOR MECHANICAL ROOF OPENINGS
Not to Scale

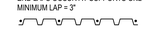
14 S0.04 TYPICAL CFMF CORNER FRAMING
Not to Scale





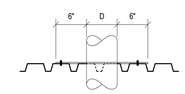
10 S0.04 JOIST BRIDING DETAILS
Not to Scale

ROOF DECK ATTACHMENT PATTERN:
FASTEN USING 36/4 PATTERN AT END LAPS (3/4"Ø WELD @12")
FASTEN USING 36/4 PATTERN AT INT. SUPPORTS (3/4"Ø WELD @12")
FASTEN SIDE LAPS AT 12" OC (#10 SCREWS @12")
FASTEN AT EDGES, PERIMETER, AND OPENINGS (3/4"Ø WELD @6")
END LAPS OCCUR AT SUPPORTS ONLY
MINIMUM LAP = 3"

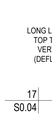


5 S0.04 STEEL DECK FASTENING
Not to Scale

15 S0.04 TYPICAL CFMF JAMB STUD
Not to Scale



6 S0.04 REINFORCING OR STEEL ROOF DECKING
Not to Scale



16 S0.04 TYPICAL CFMF LEDGER
Not to Scale

17 S0.04 DEFLECTION TRACK DETAIL
Not to Scale

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Willow School

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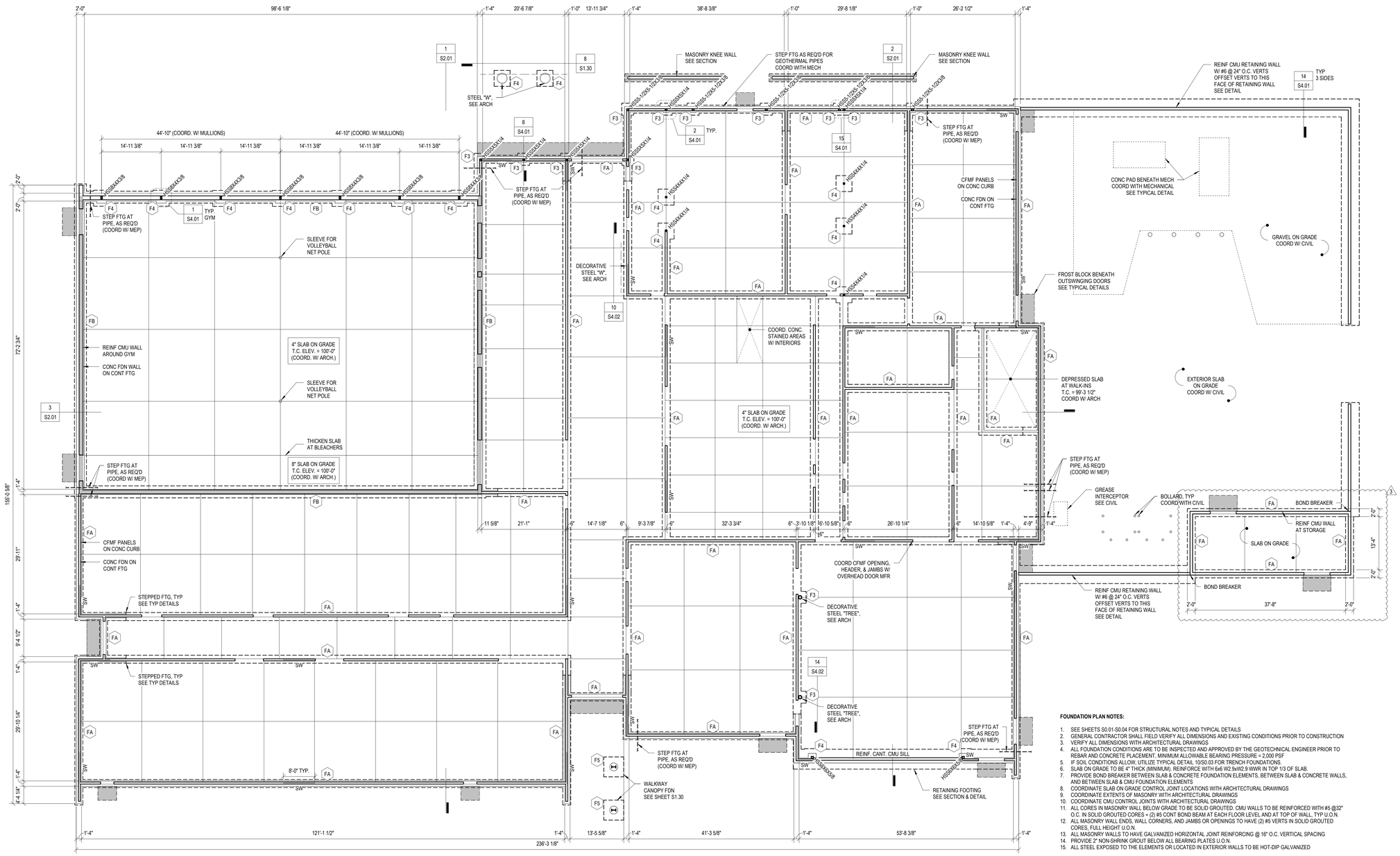
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
TYPICAL DETAILS

SHEET NO.
S0.04

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER



NORTH

1 / S1.01 FOUNDATION PLAN UNIT 100
Scale: 3/32" = 1'-0"

FOUNDATION PLAN NOTES:

1. SEE SHEETS S0.01-S0.04 FOR STRUCTURAL NOTES AND TYPICAL DETAILS
2. GENERAL CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS
4. ALL FOUNDATION CONDITIONS ARE TO BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO REBAR AND CONCRETE PLACEMENT, MINIMUM ALLOWABLE BEARING PRESSURE = 2,000 PSF
5. IF SOIL CONDITIONS ALLOW, UTILIZE TYPICAL DETAIL 10/S0.03 FOR TRENCH FOUNDATIONS.
6. SLAB ON GRADE TO BE 4" THICK (MINIMUM). REINFORCE WITH 6x6 W2.9xW2.9 WWR IN TOP 1/3 OF SLAB.
7. PROVIDE BOND BREAKER BETWEEN SLAB & CONCRETE FOUNDATION ELEMENTS, BETWEEN SLAB & CONCRETE WALLS, AND BETWEEN SLAB & CMU FOUNDATION ELEMENTS
8. COORDINATE SLAB ON GRADE CONTROL JOINT LOCATIONS WITH ARCHITECTURAL DRAWINGS
9. COORDINATE EXTENTS OF MASONRY WITH ARCHITECTURAL DRAWINGS
10. COORDINATE CMU CONTROL JOINTS WITH ARCHITECTURAL DRAWINGS
11. ALL CORES IN MASONRY WALL BELOW GRADE TO BE SOLID GROUTED. CMU WALLS TO BE REINFORCED WITH #5 @32" O.C. IN SOLID GROUTED CORES + (2) #5 CONT BOND BEAM AT EACH FLOOR LEVEL AND AT TOP OF WALL, TYP U.O.N.
12. ALL MASONRY WALL ENDS, WALL CORNERS, AND JAMBS OR OPENINGS TO HAVE (2) #5 VERTS IN SOLID GROUTED CORES, FULL HEIGHT U.O.N.
13. ALL MASONRY WALLS TO HAVE GALVANIZED HORIZONTAL JOINT REINFORCING @ 16" O.C. VERTICAL SPACING
14. PROVIDE 2" NON-SHRINK GROUT BELOW ALL BEARING PLATES U.O.N.
15. ALL STEEL EXPOSED TO THE ELEMENTS OR LOCATED IN EXTERIOR WALLS TO BE HOT-DIP GALVANIZED

FOUNDATION SCHEDULE

MARK	SIZE	REINFORCING
F3	36" x 36" x 12"	(4) #5 BOT EA WAY
F4	48" x 48" x 12"	(5) #5 BOT EA WAY
F5	60" x 60" x 15"	(6) #5 TOP & BOT EA WAY, HOOK ALL ENDS
FA	Continuous Footing - 2'-0" x 12"	CONT (3) #5 BOT
FB	Continuous Footing - 3'-0" x 12"	CONT (4) #5 BOT

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Willow School

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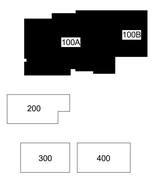
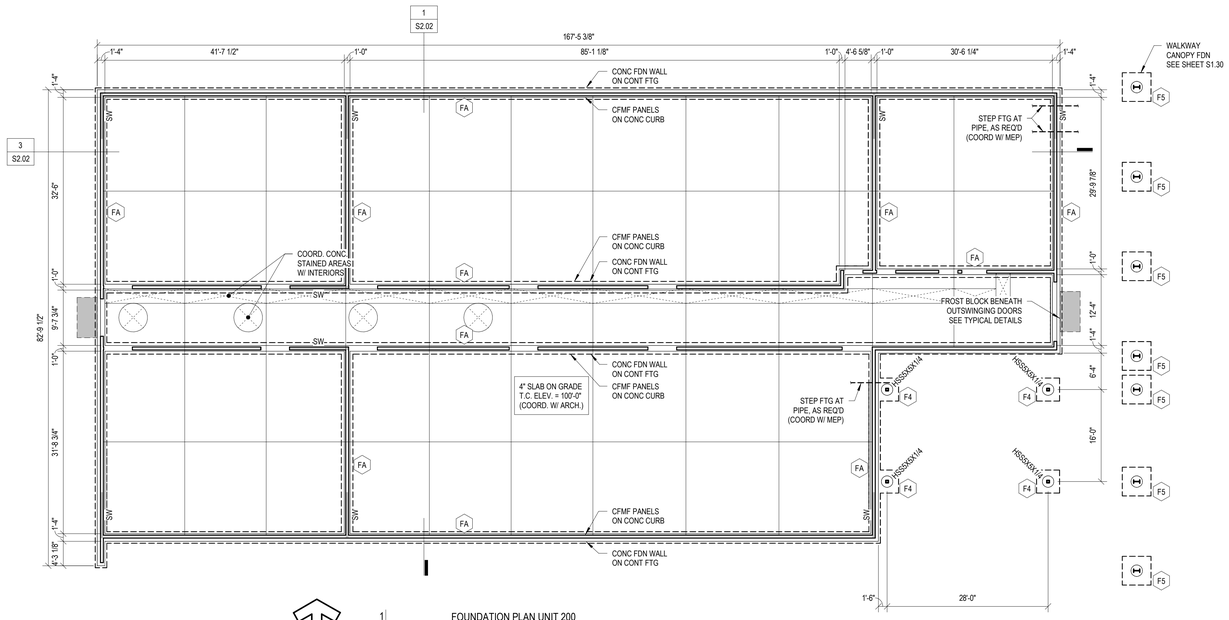
ISSUANCES	DATE
Schematic	04/21/23
Design Development	08/18/23
Bid and Construction	01/26/24
Bid Addendum 01	03/01/24
Bid Addendum 03	03/15/24



RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
FOUNDATION PLAN UNIT 100

SHEET NO.
S1.01



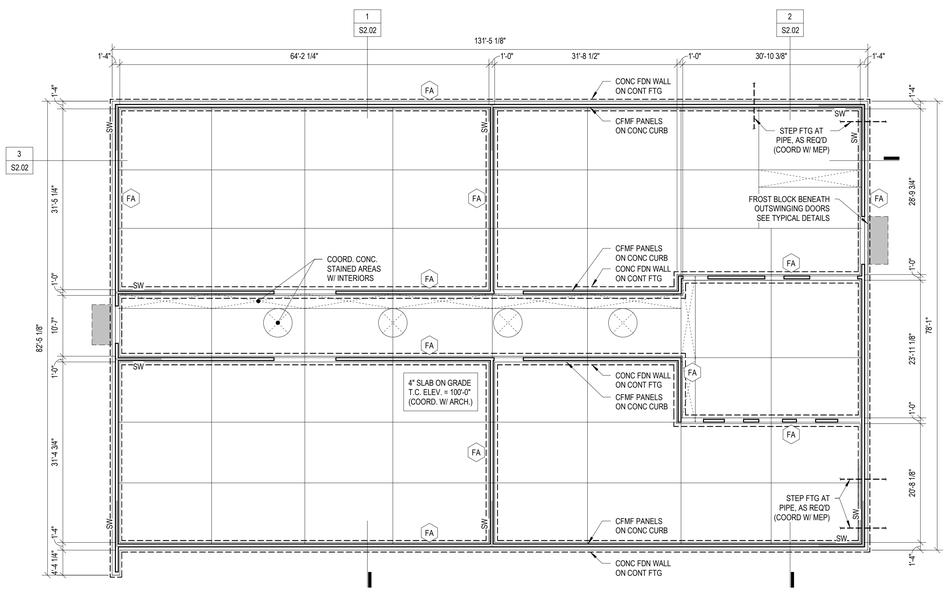
NORTH

1 / S1.02 FOUNDATION PLAN UNIT 200
Scale: 3/32" = 1'-0"

FOUNDATION SCHEDULE		
MARK	SIZE	REINFORCING
F3	36" x 36" x 12"	(4) #5 BOT EA WAY
F4	48" x 48" x 12"	(5) #5 BOT EA WAY
F5	60" x 60" x 15"	(6) #5 TOP & BOT EA WAY, HOOK ALL ENDS
FA	Continuous Footing - 2'-0" x 12"	CONT (3) #5 BOT
FB	Continuous Footing - 3'-0" x 12"	CONT (4) #5 BOT

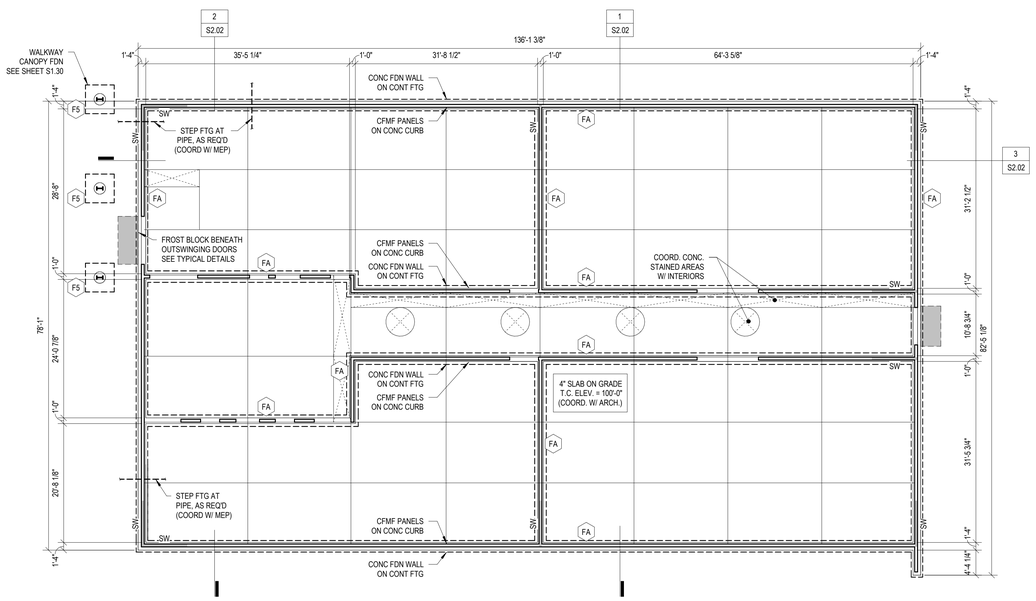
FOUNDATION PLAN NOTES:

1. SEE SHEETS S0.01-S0.04 FOR STRUCTURAL NOTES AND TYPICAL DETAILS
2. GENERAL CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS
4. ALL FOUNDATION CONDITIONS ARE TO BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO REBAR AND CONCRETE PLACEMENT, MINIMUM ALLOWABLE BEARING PRESSURE = 2,000 PSF
5. IF SOIL CONDITIONS ALLOW, UTILIZE TYPICAL DETAIL 10/S0.03 FOR TRENCH FOUNDATIONS.
6. SLAB ON GRADE TO BE 4" THICK (MINIMUM). REINFORCE WITH 6x6 W2.9xW2.9 WWR IN TOP 1/3 OF SLAB.
7. PROVIDE BOND BREAKER BETWEEN SLAB & CONCRETE FOUNDATION ELEMENTS, BETWEEN SLAB & CONCRETE WALLS, AND BETWEEN SLAB & CMU FOUNDATION ELEMENTS
8. COORDINATE SLAB ON GRADE CONTROL JOINT LOCATIONS WITH ARCHITECTURAL DRAWINGS
9. COORDINATE EXTENTS OF MASONRY WITH ARCHITECTURAL DRAWINGS
10. COORDINATE CMU CONTROL JOINTS WITH ARCHITECTURAL DRAWINGS
11. ALL CORES IN MASONRY WALL BELOW GRADE TO BE SOLID GROUTED. CMU WALLS TO BE REINFORCED WITH #5 @32" O.C. IN SOLID GROUTED CORES + (2) #5 CONT BOND BEAM AT EACH FLOOR LEVEL AND AT TOP OF WALL, TYP U.O.N.
12. ALL MASONRY WALL ENDS, WALL CORNERS, AND JAMBS OR OPENINGS TO HAVE (2) #5 VERTS IN SOLID GROUTED CORES, FULL HEIGHT U.O.N.
13. ALL MASONRY WALLS TO HAVE GALVANIZED HORIZONTAL JOINT REINFORCING @ 16" O.C. VERTICAL SPACING
14. PROVIDE 2" NON-SHRINK GROUT BELOW ALL BEARING PLATES U.O.N.
15. ALL STEEL EXPOSED TO THE ELEMENTS OR LOCATED IN EXTERIOR WALLS TO BE HOT-DIP GALVANIZED



NORTH

2 / S1.02 FOUNDATION PLAN UNIT 300
Scale: 3/32" = 1'-0"



NORTH

3 / S1.02 FOUNDATION PLAN UNIT 400
Scale: 3/32" = 1'-0"

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Willow School

Lansing School District

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Lansing, MI 48915

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ISSUANCES	DATE
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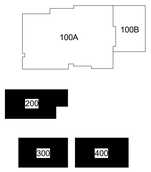
Bid and Construction	01/26/24
Bid Addendum 01	03/01/24

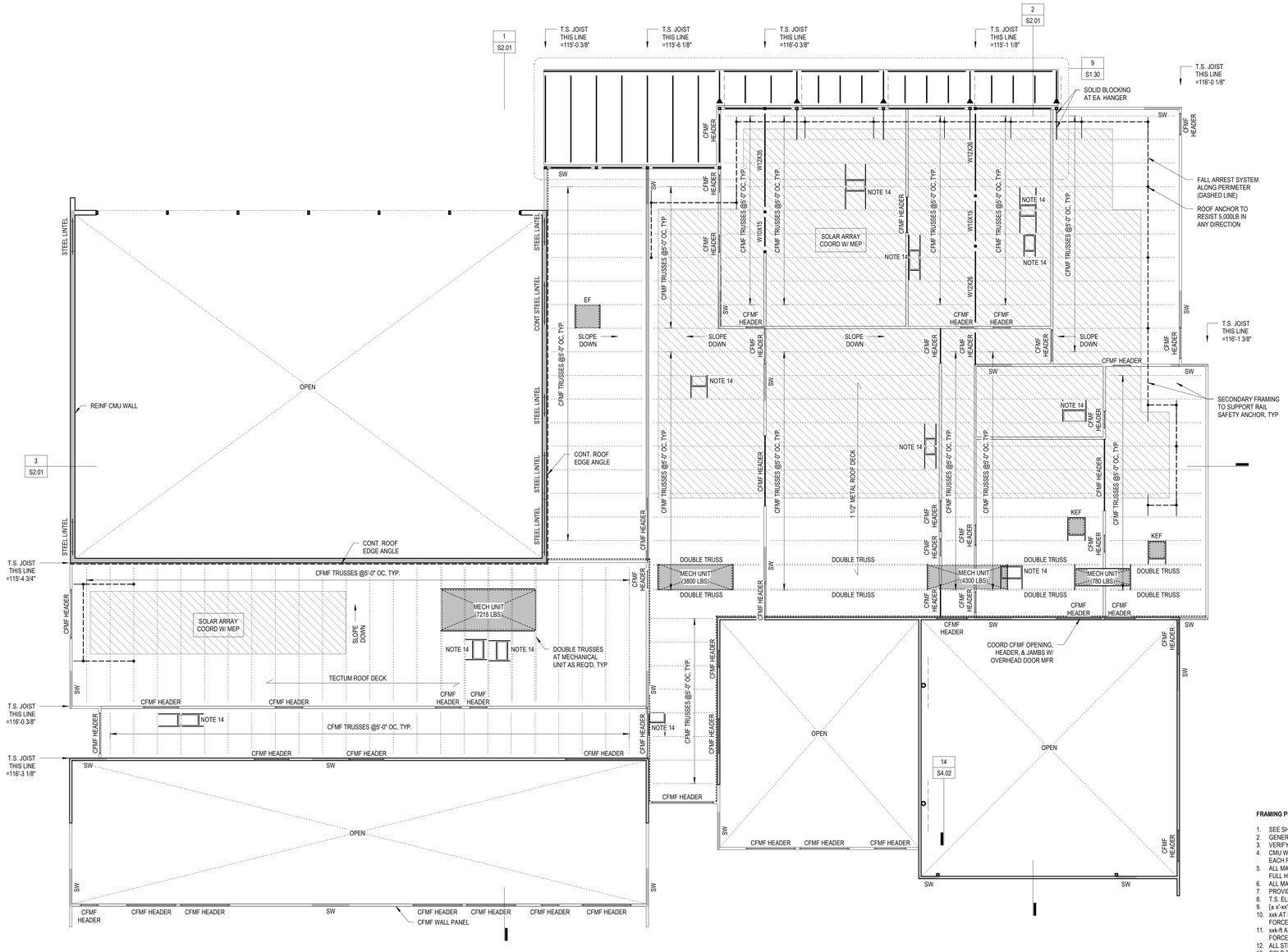


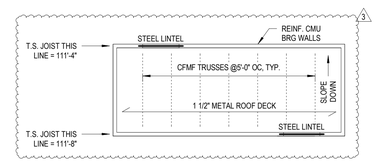
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
FOUNDATION PLAN
UNITS 200, 300, 400

SHEET NO.
S1.02





1 S1.11 LOW ROOF FRAMING PLAN UNIT 100
Scale: 3/32" = 1'-0"

FRAMING PLAN NOTES:

1. SEE SHEETS S0.01-S0.04 FOR STRUCTURAL NOTES AND TYPICAL DETAILS
2. GENERAL CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS
4. CMU WALLS TO BE REINFORCED WITH #5 VERTICAL @ 32" O.C. IN SOLID GROUTED CORES + (2) #5 CONT BOND BEAM AT EACH FLOOR LEVEL AND AT TOP OF WALL. TYP U.O.N.
5. ALL MASONRY WALL ENDS, WALL CORNERS, AND JAMBS OR OPENINGS TO HAVE (2) #5 VERTS IN SOLID GROUTED CORES, FULL HEIGHT U.O.N.
6. ALL MASONRY WALLS TO HAVE GALVANIZED HORIZONTAL JOINT REINFORCING @ 16" O.C.
7. PROVIDE 2" NON-SHRINK GROUT BELOW ALL BEARING PLATES U.O.N.
8. T.S. ELEVATION GIVEN AT UNDERSIDE OF DECK
9. [x.x'-xx"] DENOTES ELEVATION FROM GIVEN DATUM
10. xxk AT BEAM ENDS DENOTES FACTORED BEAM REACTIONS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM REACTION = 25 KIPS)
11. xxk-ft AT BEAM ENDS DENOTES FACTORED BEAM MOMENTS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM END MOMENT = 50 K-FT)
12. ALL STEEL EXPOSED TO THE ELEMENTS OR LOCATED IN EXTERIOR WALLS TO BE HOT-DIP GALVANIZED
13. COLD-FORMED METAL FRAMED WALLS, HEADERS, AND GIRDERS ARE TO BE DESIGNED BY CFMF SUPPLIER
14. HANGING MECHANICAL UNIT. WEIGHT VARIES FROM 150 LBS TO 425 LBS., COORD. WITH MECHANICAL.
15. MECHANICAL UNIT WEIGHTS DO NOT INCLUDE CURB.
16. EXTERIOR WALL SHEATHING TO BE 5/8" GYP SHEATHING FASTEN WITH 8d @ 6" O.C. EDGE. @ 12" O.C. FIELD
17. TRUSS SHOP DRAWINGS TO BE PREPARED BY THE TRUSS SUPPLIER AND SEALED BY A REGISTERED ENGINEER.
18. SEE TRUSS LAYOUT SHOP DRAWINGS FOR FINAL DESIGNS, LAYOUT, REQUIRED BLOCKING, AND BRIDGING.
19. FOLLOW TRUSS SUPPLIER DRAWINGS AND NOTES FOR CONSTRUCTION SEQUENCE, TEMPORARY BRACING, HANDLING, AND STORAGE REQUIREMENTS.
20. ALL FRAMING CLIPS, STRAPS, AND HANGERS TO BE SIMPSON STRONG-TIE OR APPROVED EQUAL, U.O.N.
21. ALL HANGERS, FASTENERS, NAILS, SCREWS, ETC. TO BE STAINLESS STEEL AT EXTERIOR CONDITIONS. ALL MEMBERS AT EXTERIOR CONDITIONS TO BE P.P.T.

COLD-FORMED SHEAR WALL SCHEDULE (MIN.)

MARK	SHEATHING	FASTENER SPACING	JAMB STUD SIZE	LENGTH
SW	5/8" GYP (MIN), BOTH SIDES	6"OC EDGES / 12"OC FIELD	(2) 600S162-43	8'-0" TYP.

COLD-FORMED WALL SCHEDULE (MIN.)

MARK	STUD SIZE	TOP+BOT TRACK
--	600S162-43 @16"OC	600T125-43

COLD-FORMED COLUMN SCHEDULE (MIN.)

MARK	POST SIZE	COMMENTS
--	(2) 600S162-43	BOXED

COLD-FORMED HEADER SCHEDULE (MIN.)

MARK	BEAM SIZE	TOP+BOT TRACK
--	(2) 600S162-43	600T125-43

COLD-FORMED JOIST SCHEDULE (MIN.)

MARK	JOIST SIZE	COMMENTS
--	6S162-43 @16" OC	--

COLD-FORMED HEADER SCHEDULE (MIN.)

MARK	HEADER SIZE	TOP+BOT. TRACK	SILL SIZE	SHOULDER STUDS
--	(2) 600S162-54	600T125-43	600T125-43	600T125-43

*CFMF IS A DELEGATED DESIGN ITEM. MEMBER SIZES SHOWN ARE **MINIMUM** DEPTH, GAUGES, AND SPACINGS WHICH MAY REQUIRE LARGER SIZES BASED ON ANALYSIS AND DESIGN BY SUPPLIER'S ENGINEER. REFER TO SPECIFICATIONS.

KINGSCOTT
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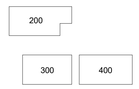
Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Schematic	04/21/23
Design Development	08/18/23
Bid and Construction	01/26/24
Bid Addendum 03	03/15/24

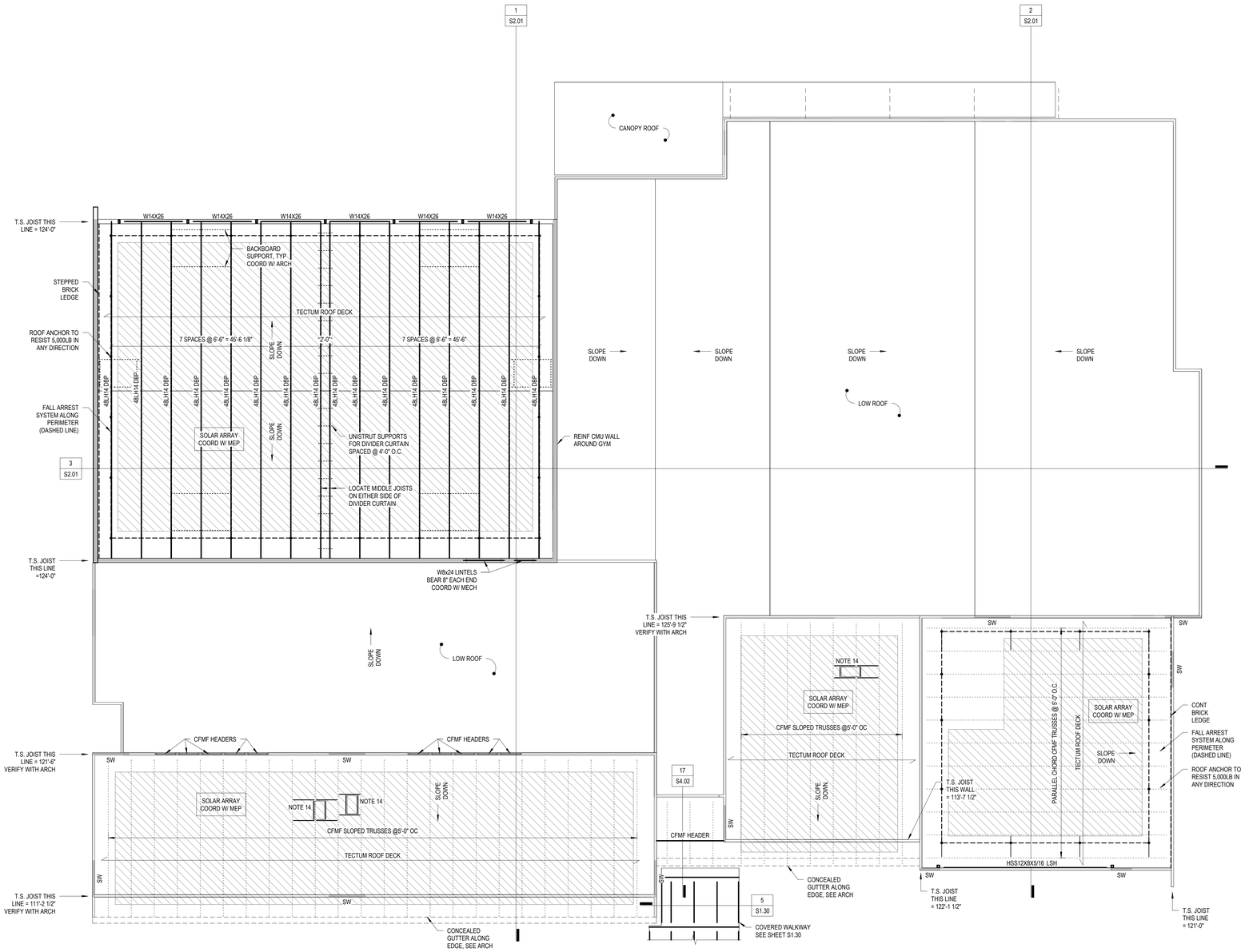


RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
LOW ROOF FRAMING PLAN
UNIT 100

SHEET NO.
S1.11



NORTH

1 S1.21 HIGH ROOF FRAMING PLAN UNIT 100
Scale: 3/32" = 1'-0"

FRAMING PLAN NOTES:

1. SEE SHEETS S0.01-S0.04 FOR STRUCTURAL NOTES AND TYPICAL DETAILS
2. GENERAL CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS
4. CMU WALLS TO BE REINFORCED WITH #5 VERTICAL @ 32" O.C. IN SOLID GROUTED CORES + (2) #5 CONT BOND BEAM AT EACH FLOOR LEVEL AND AT TOP OF WALL, TYP U.O.N.
5. ALL MASONRY WALL ENDS, WALL CORNERS, AND JAMBS OR OPENINGS TO HAVE (2) #5 VERTS IN SOLID GROUTED CORES, FULL HEIGHT U.O.N.
6. ALL MASONRY WALLS TO HAVE GALVANIZED HORIZONTAL JOINT REINFORCING @ 16" O.C.
7. PROVIDE 2" NON-SHRINK GROUT BELOW ALL BEARING PLATES U.O.N.
8. T.S. ELEVATION GIVEN AT UNDERSIDE OF DECK.
9. [x x'-xx"] DENOTES ELEVATION FROM GIVEN DATUM
10. xxk AT BEAM ENDS DENOTES FACTORED BEAM REACTIONS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM REACTION = 25 KIPS)
11. xxk-ft AT BEAM ENDS DENOTES FACTORED BEAM MOMENTS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM END MOMENT = 50 K-FT)
12. ALL STEEL EXPOSED TO THE ELEMENTS OR LOCATED IN EXTERIOR WALLS TO BE HOT-DIP GALVANIZED
13. COLD-FORMED METAL FRAMED WALLS, HEADERS, AND GIRDERS ARE TO BE DESIGNED BY CFMF SUPPLIER
14. HANGING MECHANICAL UNIT. WEIGHT VARIES FROM 150 LBS TO 425 LBS., COORD. WITH MECHANICAL.
15. MECHANICAL UNIT WEIGHTS DO NOT INCLUDE CURB.
16. EXTERIOR WALL SHEATHING TO BE 5/8" GYP SHEATHING, FASTEN WITH 8d @ 6" O.C. EDGE, @ 12" O.C. FIELD
17. TRUSS SHOP DRAWINGS TO BE PREPARED BY THE TRUSS SUPPLIER AND SEALED BY A REGISTERED ENGINEER.
18. SEE TRUSS LAYOUT SHOP DRAWINGS FOR FINAL DESIGNS, LAYOUT, REQUIRED BLOCKING, AND BRIDGING.
19. FOLLOW TRUSS SUPPLIER DRAWINGS AND NOTES FOR CONSTRUCTION SEQUENCE, TEMPORARY BRACING, HANDLING, AND STORAGE REQUIREMENTS.
20. ALL FRAMING CLIPS, STRAPS, AND HANGERS TO BE SIMPSON STRONG-TIE OR APPROVED EQUAL, U.O.N.
21. ALL HANGERS, FASTENERS, NAILS, SCREWS, ETC. TO BE STAINLESS STEEL AT EXTERIOR CONDITIONS. ALL MEMBERS AT EXTERIOR CONDITIONS TO BE P.P.T.

COLD-FORMED SHEAR WALL SCHEDULE (MIN.)

MARK	SHEATHING	FASTENER SPACING	JAMB STUD SIZE	LENGTH
SW	5/8" GYP (MIN), BOTH SIDES	6"OC EDGES / 12"OC FIELD	(2) 600S162-43	8'-0" TYP.

COLD-FORMED WALL SCHEDULE (MIN.)

MARK	STUD SIZE	TOP+BOT TRACK
--	600S162-43 @16"OC	600T125-43

COLD-FORMED COLUMN SCHEDULE (MIN.)

MARK	POST SIZE	COMMENTS
--	(2) 600S162-43	BOXED

COLD-FORMED HEADER SCHEDULE (MIN.)

MARK	BEAM SIZE	TOP+BOT TRACK
--	(2) 600S162-43	600T125-43

COLD-FORMED JOIST SCHEDULE (MIN.)

MARK	JOIST SIZE	COMMENTS
--	6S162-43 @16" OC	--

COLD-FORMED HEADER SCHEDULE (MIN.)

MARK	HEADER SIZE	TOP+BOT. TRACK	SILL SIZE	SHOULDER STUDS
--	(2) 600S162-54	600T125-43	600T125-43	600T125-43

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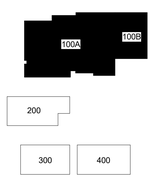
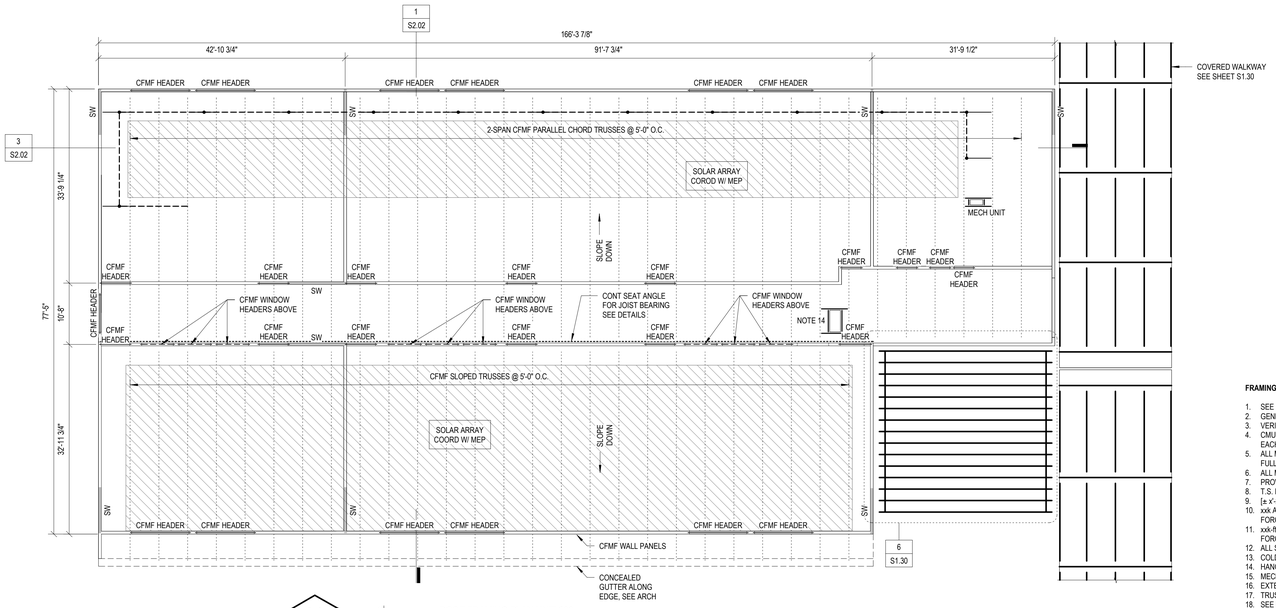


RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
HIGH ROOF FRAMING PLAN
UNIT 100

SHEET NO.
S1.21



NORTH

1 S1.22 ROOF FRAMING PLAN UNIT 200
Scale: 3/32" = 1'-0"

FRAMING PLAN NOTES:

1. SEE SHEETS S0.01-S0.04 FOR STRUCTURAL NOTES AND TYPICAL DETAILS
2. GENERAL CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS
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5. ALL MASONRY WALL ENDS, WALL CORNERS, AND JAMBS OR OPENINGS TO HAVE (2) #5 VERTS IN SOLID GROUTED CORES, FULL HEIGHT U.O.N.
6. ALL MASONRY WALLS TO HAVE GALVANIZED HORIZONTAL JOINT REINFORCING @ 16" O.C.
7. PROVIDE 2" NON-SHRINK GROUT BELOW ALL BEARING PLATES U.O.N.
8. T.S. ELEVATION GIVEN AT UNDERSIDE OF DECK
9. [± x'-xx"] DENOTES ELEVATION FROM GIVEN DATUM
10. xxk AT BEAM ENDS DENOTES FACTORED BEAM REACTIONS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM REACTION = 25 KIPS)
11. xxk-ft AT BEAM ENDS DENOTES FACTORED BEAM MOMENTS. BEAM END AND CONNECTIONS SHALL BE DESIGNED FOR THAT FORCE. (MINIMUM END MOMENT = 50 K-FT)
12. ALL STEEL EXPOSED TO THE ELEMENTS OR LOCATED IN EXTERIOR WALLS TO BE HOT-DIP GALVANIZED
13. COLD-FORMED METAL FRAMED WALLS, HEADERS, AND GIRDERS ARE TO BE DESIGNED BY CFMF SUPPLIER
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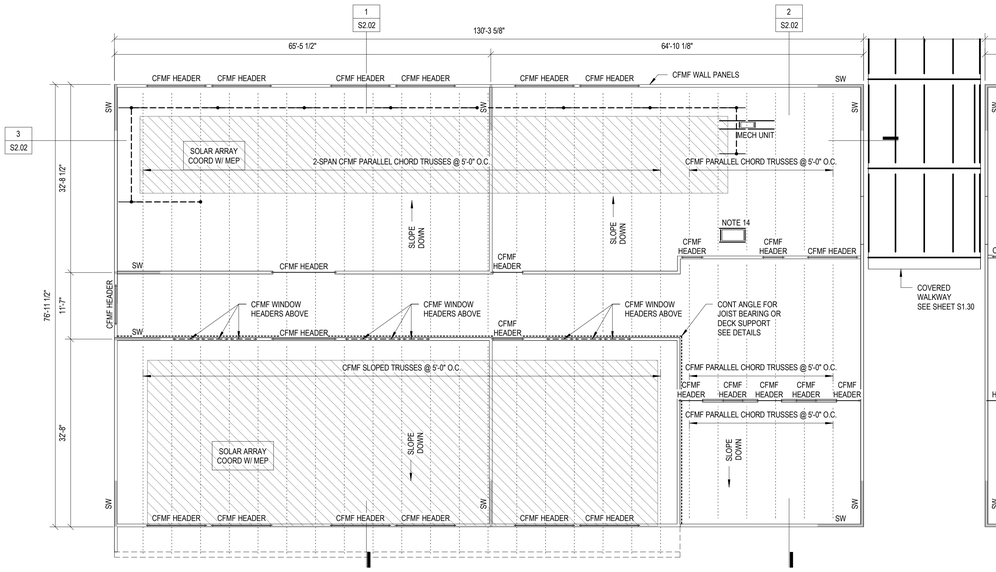
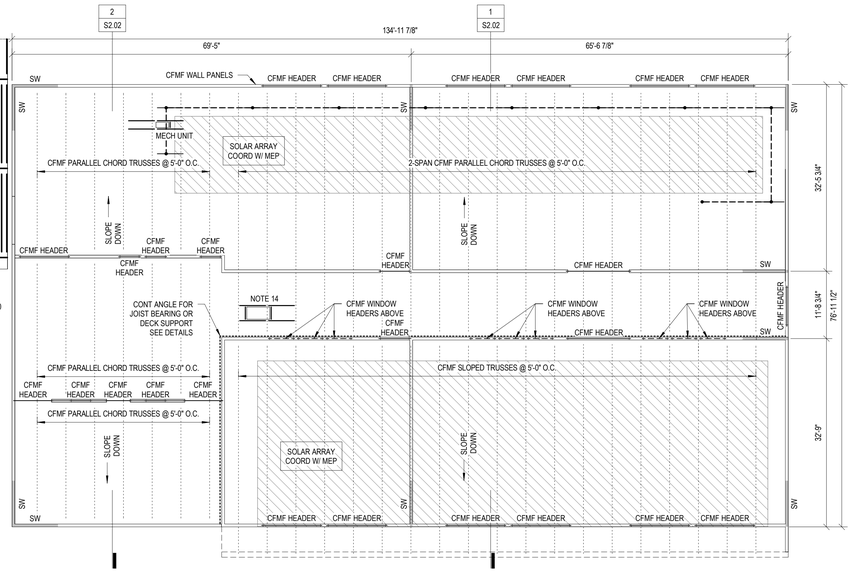


NORTH

2 S1.22 ROOF FRAMING PLAN UNIT 300
Scale: 3/32" = 1'-0"



NORTH

3 S1.22 ROOF FRAMING PLAN UNIT 400
Scale: 3/32" = 1'-0"

COLD-FORMED SHEAR WALL SCHEDULE (MIN.)				
MARK	SHEATHING	FASTENER SPACING	JAMB STUD SIZE	LENGTH
SW	5/8" GYP (MIN), BOTH SIDES	6"OC EDGES / 12"OC FIELD	(2) 600S162-43	8'-0" TYP.

COLD-FORMED WALL SCHEDULE (MIN.)		
MARK	STUD SIZE	TOP+BOT TRACK
--	600S162-43 @16"OC	600T125-43

COLD-FORMED COLUMN SCHEDULE (MIN.)		
MARK	POST SIZE	COMMENTS
--	(2) 600S162-43	BOXED

COLD-FORMED HEADER SCHEDULE (MIN.)		
MARK	BEAM SIZE	TOP+BOT TRACK
--	(2) 600S162-43	600T125-43

COLD-FORMED JOIST SCHEDULE (MIN.)		
MARK	JOIST SIZE	COMMENTS
--	6S162-43 @16" OC	--

COLD-FORMED HEADER SCHEDULE (MIN.)				
MARK	HEADER SIZE	TOP+BOT. TRACK	SILL SIZE	SHOULDER STUDS
--	(2) 600S162-54	600T125-43	600T125-43	600T125-43

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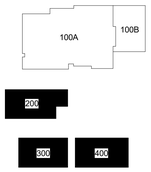
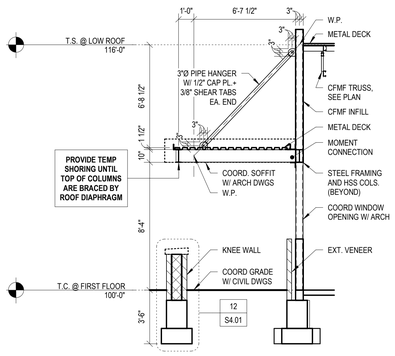


RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

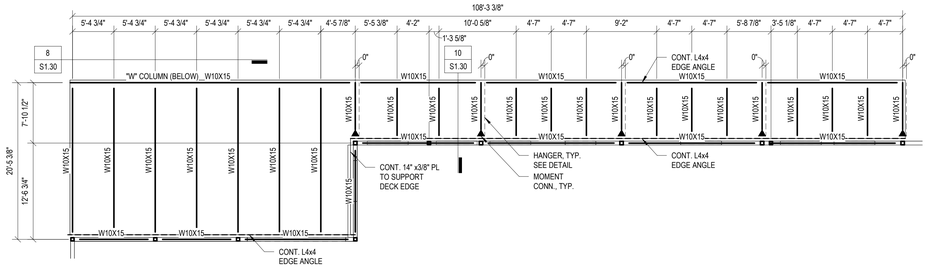
N

SHEET TITLE
ROOF FRAMING PLAN
UNITS 200, 300, 400

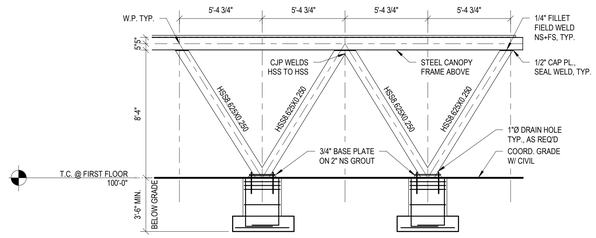
SHEET NO.
S1.22



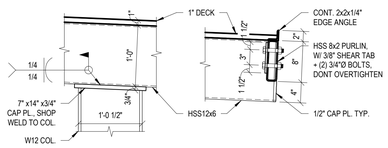
10 S1.30 SECTION OF UNIT 100 ENTRY CANOPY
Scale: 1/4" = 1'-0"



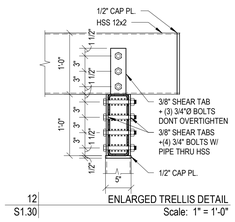
9 S1.30 UNIT 100 ENTRY CANOPY FRAMING PLAN
Scale: 1/8" = 1'-0"



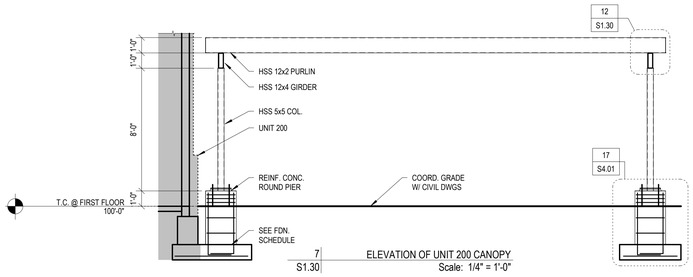
8 S1.30 EXTERIOR "W" COLUMN ELEVATION
Scale: 1/4" = 1'-0"



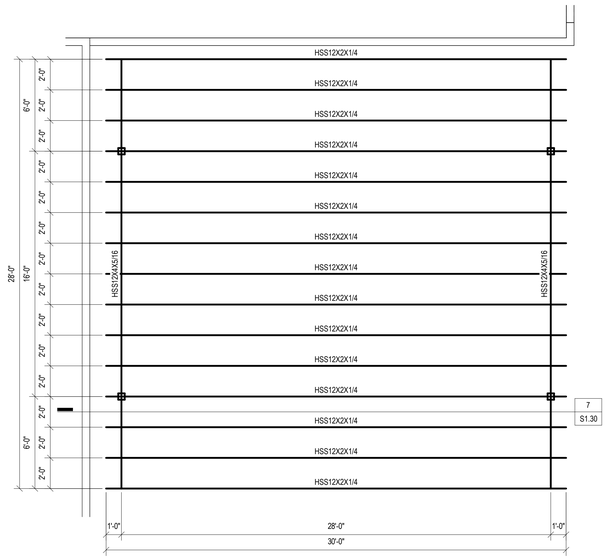
11 S1.30 ENLARGED CANOPY DETAILS
Scale: 1" = 1'-0"



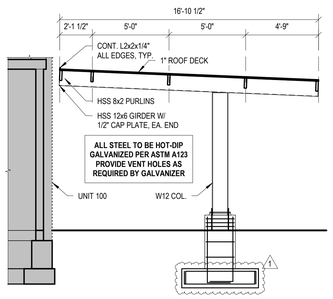
12 S1.30 ENLARGED TRELLIS DETAIL
Scale: 1" = 1'-0"



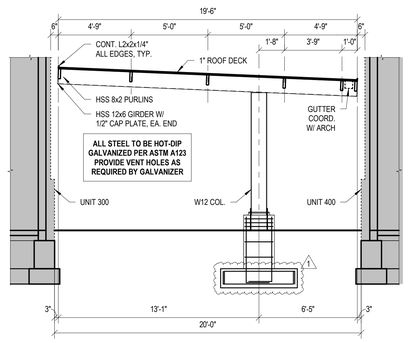
7 S1.30 ELEVATION OF UNIT 200 CANOPY
Scale: 1/4" = 1'-0"



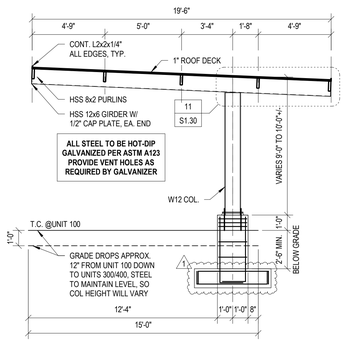
6 S1.30 UNIT 200 TRELLIS FRAMING PLAN
Scale: 1/4" = 1'-0"



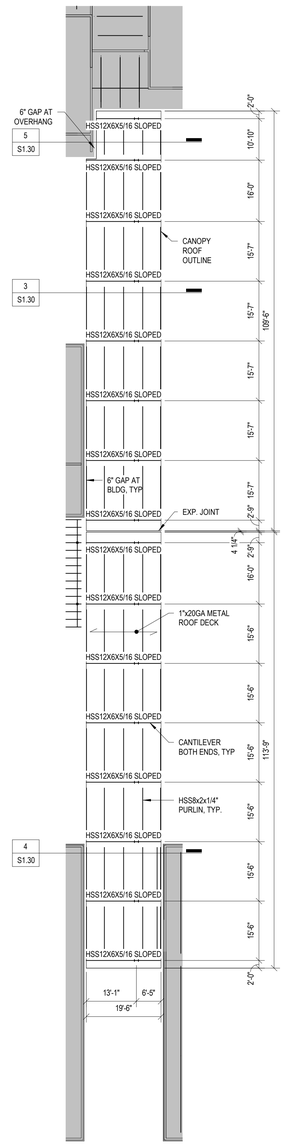
5 S1.30 COVERED WALKWAY DETAIL AT UNIT 100
Scale: 1/4" = 1'-0"



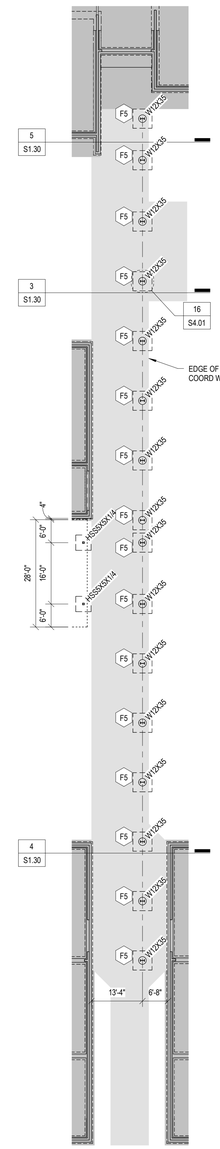
4 S1.30 COVERED WALKWAY DETAIL BETWEEN UNITS 300 & 400
Scale: 1/4" = 1'-0"



3 S1.30 TYPICAL DETAIL AT COVERED WALKWAY
Scale: 1/4" = 1'-0"



2 S1.30 COVERED WALKWAY FRAMING PLAN1
Scale: 1/16" = 1'-0"



1 S1.30 COVERED WALKWAY FOUNDATION PLAN
Scale: 1/16" = 1'-0"

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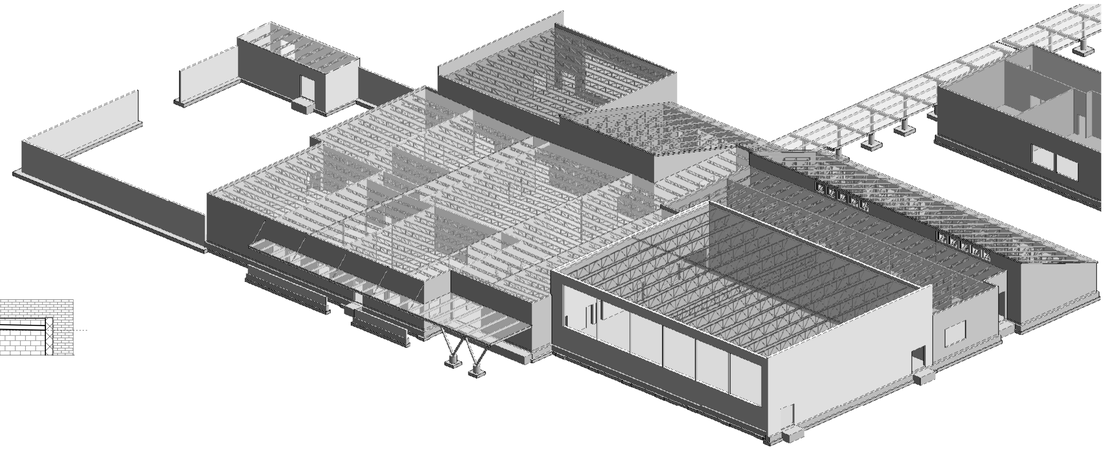
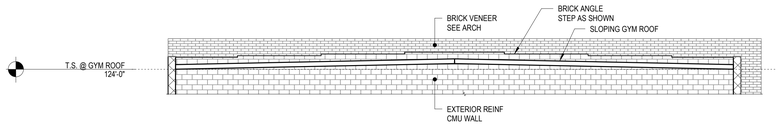
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

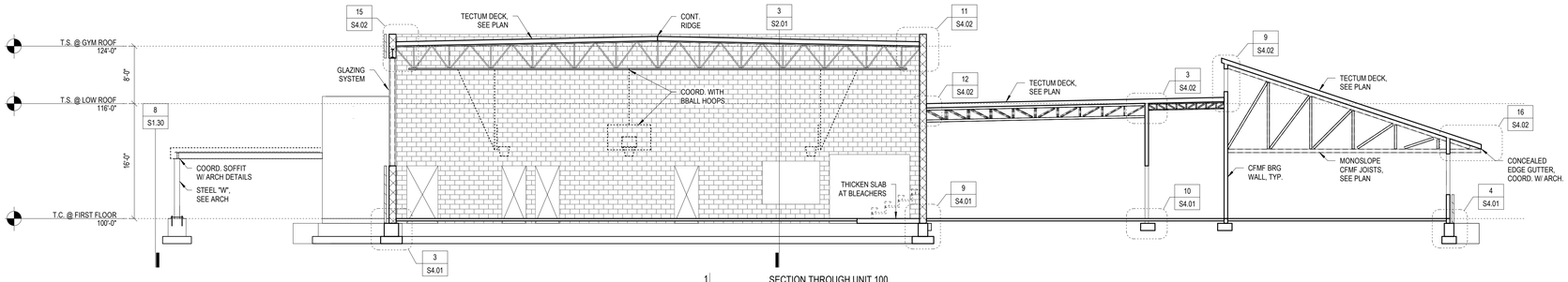
SHEET TITLE
ENLARGED STEEL FRAMING PLANS AND DETAILS

SHEET NO.
S1.30

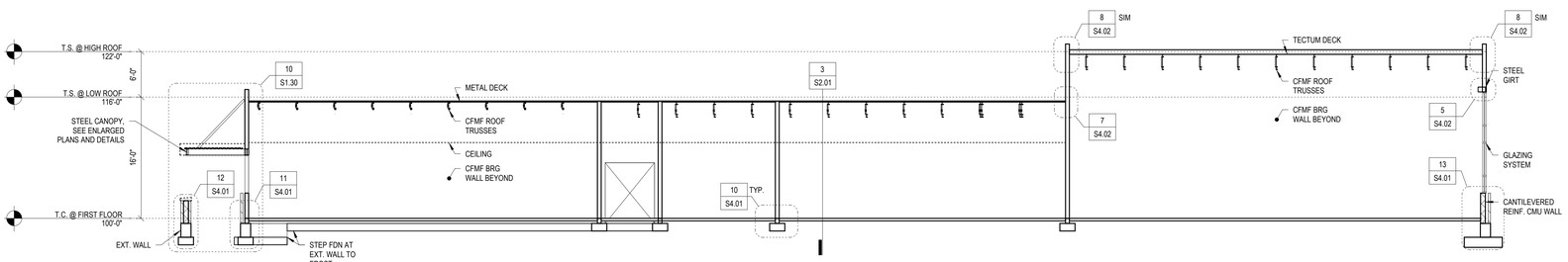




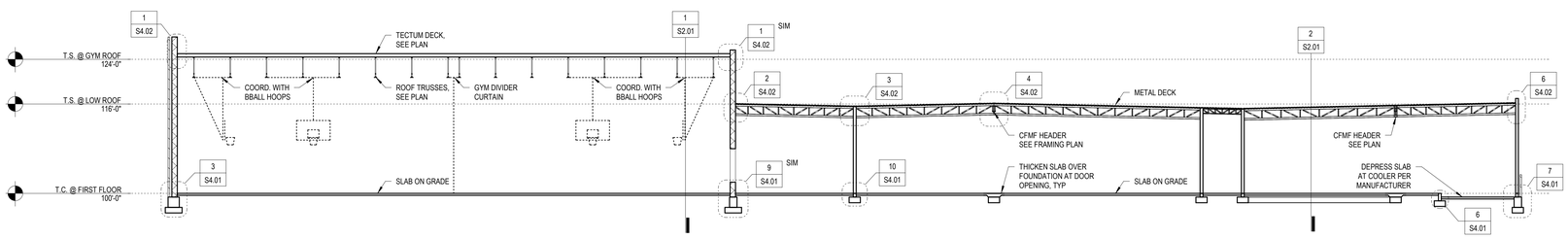
5 / S2.01 INTERIOR ELEVATION OF WEST WALL AT GYM ROOF
Scale: 1/8" = 1'-0"



1 / S2.01 SECTION THROUGH UNIT 100
Scale: 1/8" = 1'-0"



2 / S2.01 SECTION THROUGH UNIT 100
Scale: 1/8" = 1'-0"



3 / S2.01 SECTION THROUGH UNIT 100
Scale: 3/32" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

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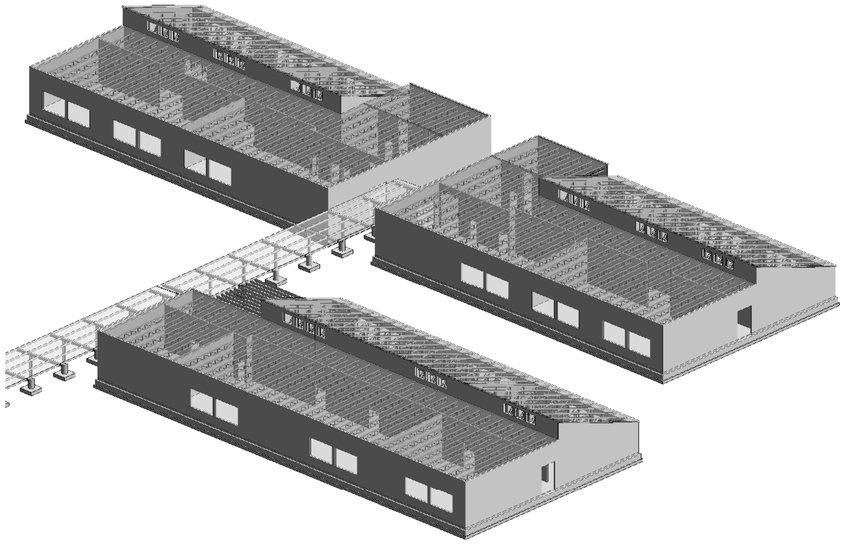
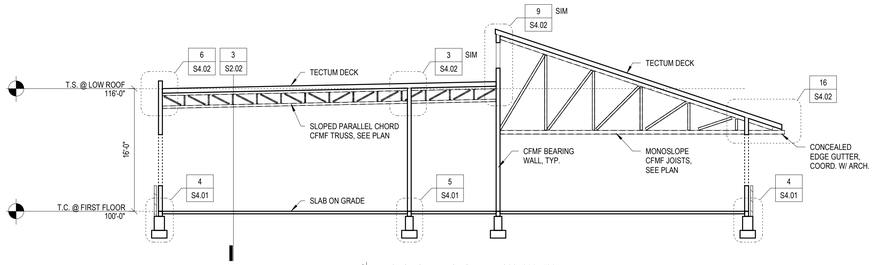
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
SECTIONS & ISOMETRIC UNIT 100

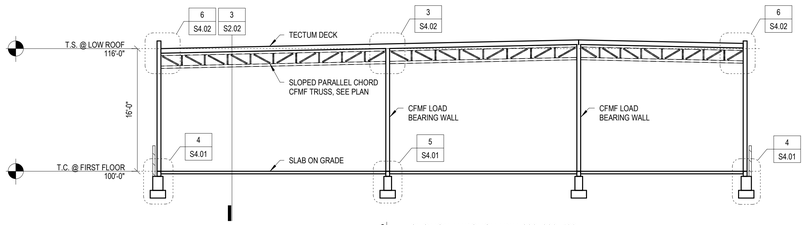
SHEET NO.
S2.01

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER





1 SECTION THROUGH UNIT 200, 300, 400
S2.02 Scale: 1/8" = 1'-0"



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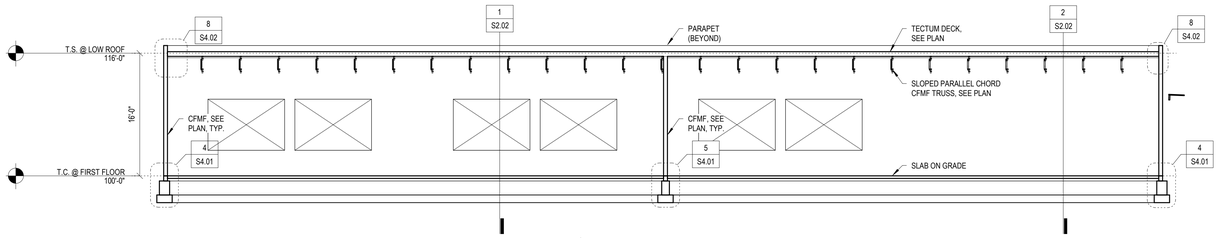

3 SECTION THROUGH UNIT 200, 300, 400
S2.02 Scale: 1/8" = 1'-0"

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

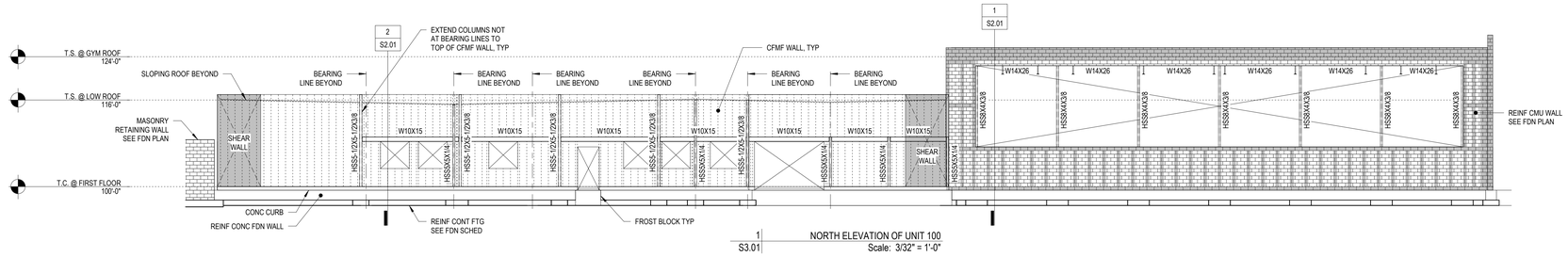
ISSUANCES	DATE
Schematic	04/21/23
Design Development	08/18/23
Bid and Construction	01/26/24

STATE OF MICHIGAN
BRAD
CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER

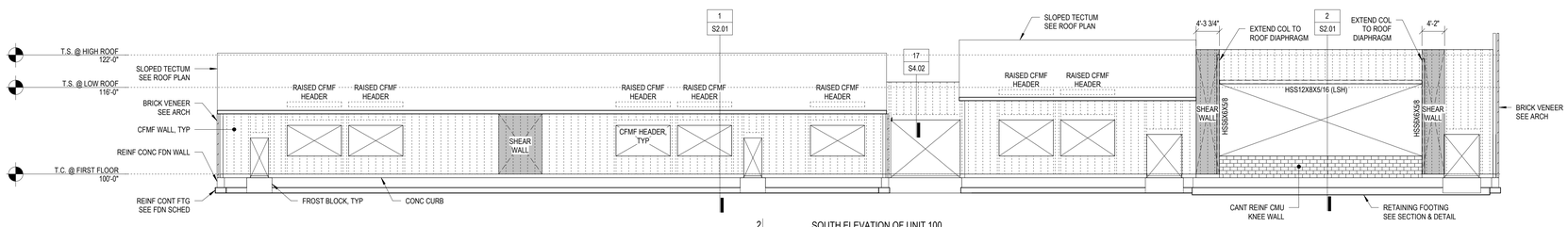
RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
SECTIONS & ISOMETRIC UNITS 200, 300, 400

SHEET NO.
S2.02



1 / S3.01 NORTH ELEVATION OF UNIT 100
Scale: 3/32" = 1'-0"



2 / S3.01 SOUTH ELEVATION OF UNIT 100
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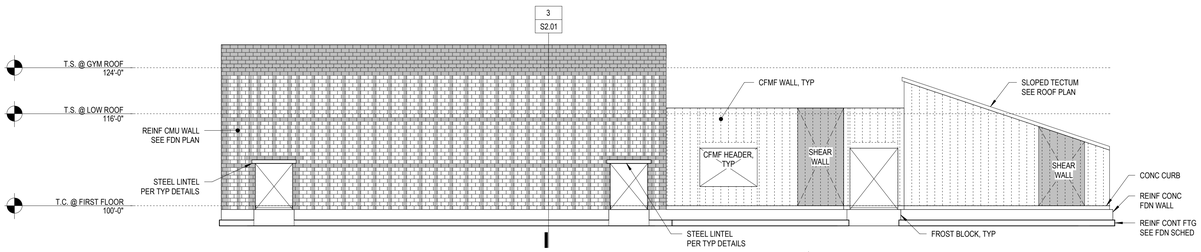
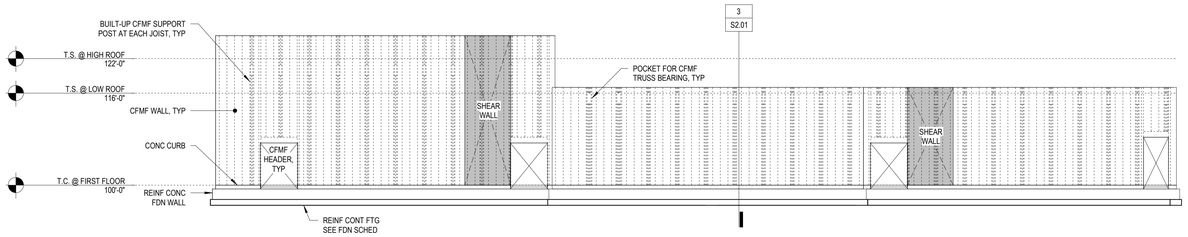


3 / S3.01 WEST ELEVATION OF UNIT 100
Scale: 3/32" = 1'-0"



4 / S3.01 EAST ELEVATION OF UNIT 100
Scale: 3/32" = 1'-0"

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Lansing School District
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Lansing School District

ISSUANCES	DATE
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Bid and Construction	01/26/24

RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
EXTERIOR ELEVATIONS
UNIT 100

SHEET NO.
S3.01

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
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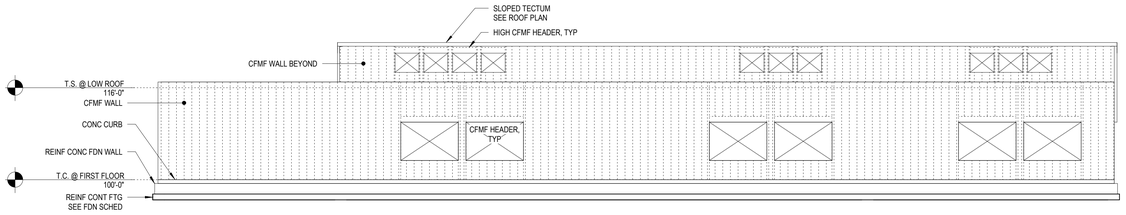
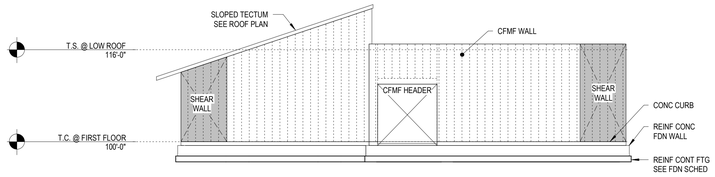


1 S3.02 NORTH ELEVATION OF UNIT 200
Scale: 3/32" = 1'-0"



2 S3.02 EAST ELEVATION OF UNIT 200
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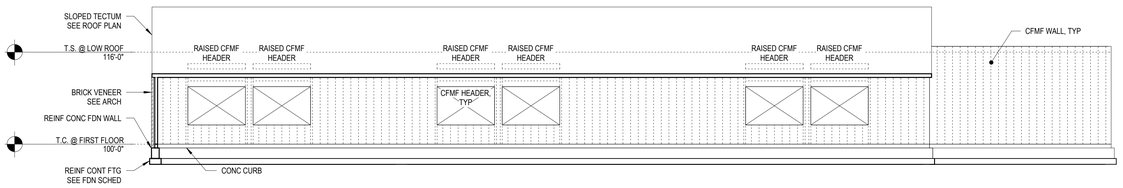
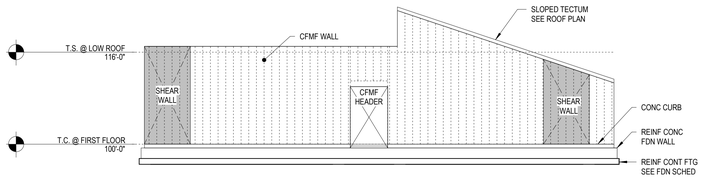
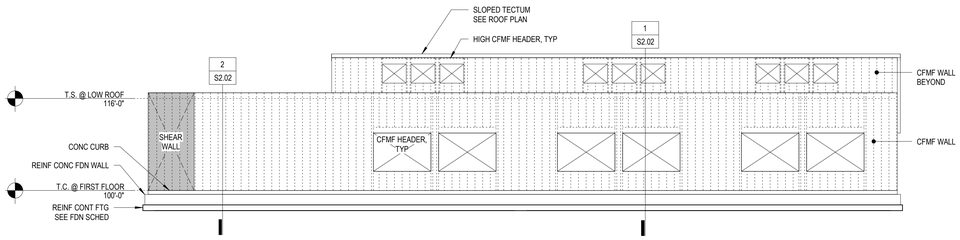


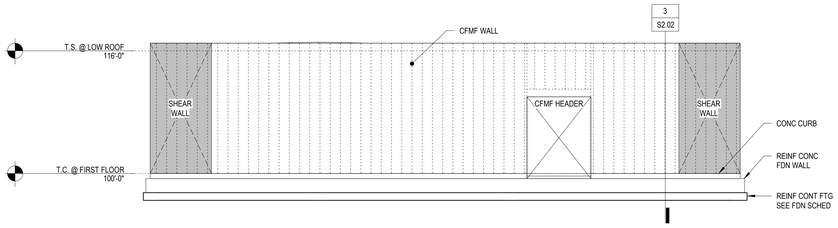
3 S3.02 SOUTH ELEVATION OF UNIT 200
Scale: 3/32" = 1'-0"



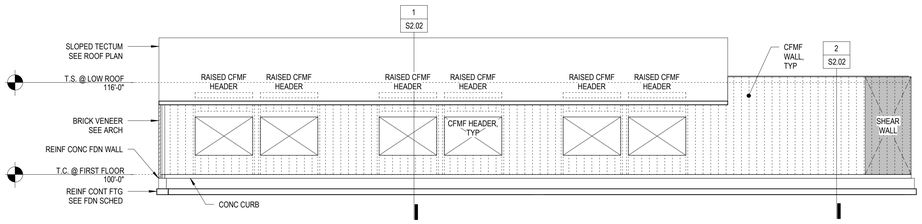
4 S3.02 WEST ELEVATION OF UNIT 200
Scale: 3/32" = 1'-0"



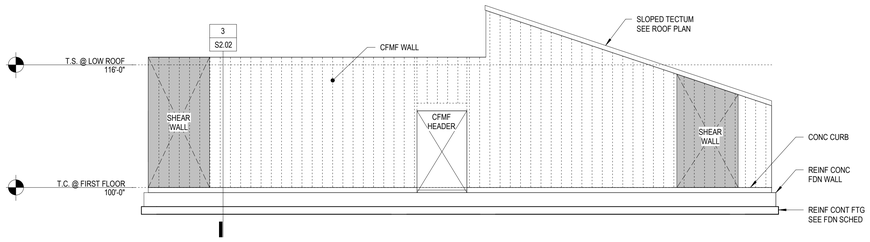
5 S3.02 NORTH ELEVATION OF UNIT 300/400
Scale: 3/32" = 1'-0"



6 S3.02 EAST ELEVATION OF UNIT 300/400
Scale: 1/8" = 1'-0"



7 S3.02 SOUTH ELEVATION OF UNIT 300/400
Scale: 3/32" = 1'-0"



8 S3.02 WEST ELEVATION OF UNIT 300/400
Scale: 1/8" = 1'-0"

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Lansing School District

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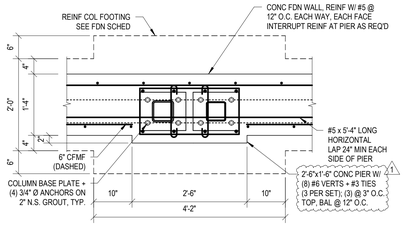
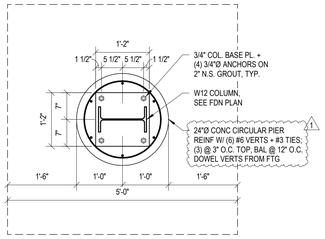
JOB NO. 2616.01A

SHEET TITLE
EXTERIOR ELEVATIONS
UNITS 200, 300, 400

SHEET NO.
S3.02



15 S4.01 COMBINED PIER DETAIL
Scale: 3/4" = 1'-0"



16 S4.01 CANOPY PIER DETAIL
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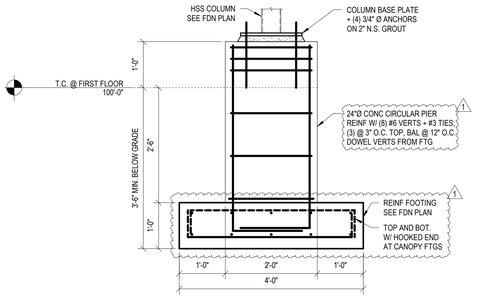
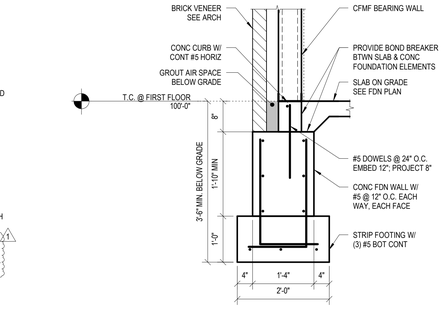
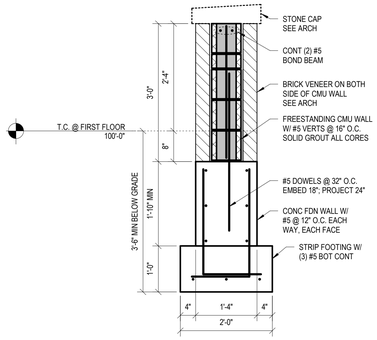


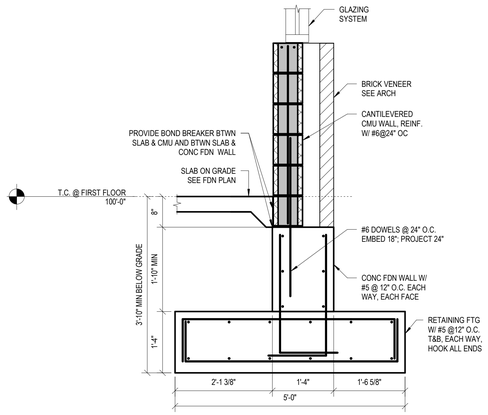
17 S4.01 TRELLIS & CANOPY FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



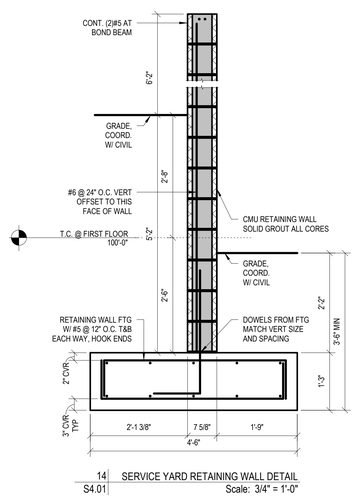
11 S4.01 TYPICAL FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



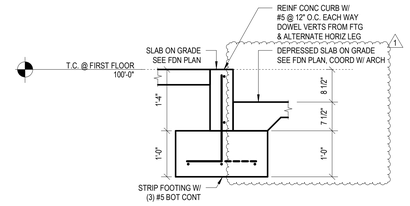
12 S4.01 UNIT 100 LOW WALL DETAIL
Scale: 3/4" = 1'-0"



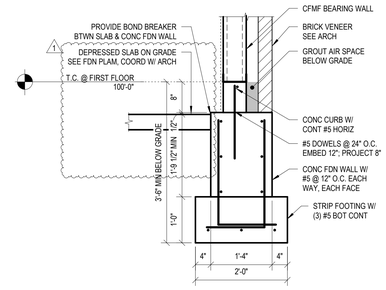
13 S4.01 CAFETERIA SOUTH WALL FOUNDATION
Scale: 3/4" = 1'-0"



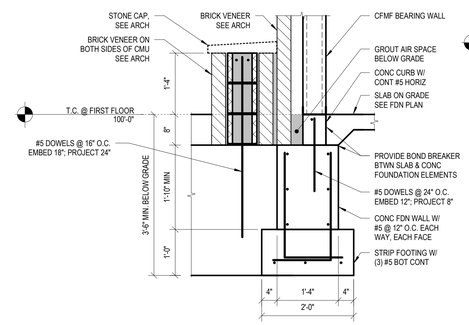
14 S4.01 SERVICE YARD RETAINING WALL DETAIL
Scale: 3/4" = 1'-0"



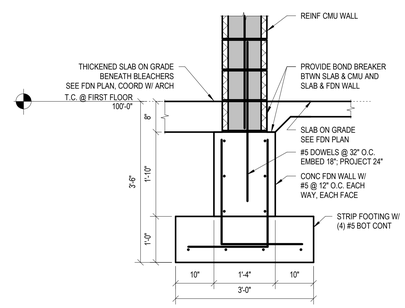
6 S4.01 FOUNDATION DETAIL AT INTERIOR WALL OF WALK-IN COOLER
Scale: 3/4" = 1'-0"



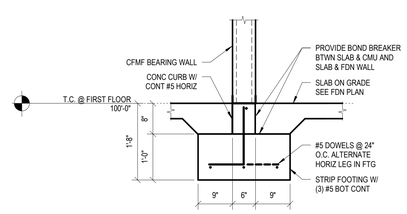
7 S4.01 FOUNDATION DETAIL AT EXTERIOR WALL OF WALK-IN COOLER
Scale: 3/4" = 1'-0"



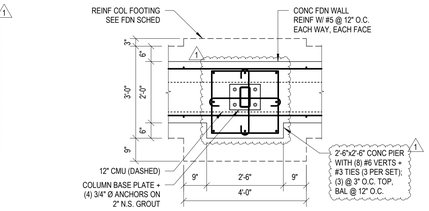
8 S4.01 EXTERIOR BENCH DETAIL
Scale: 3/4" = 1'-0"



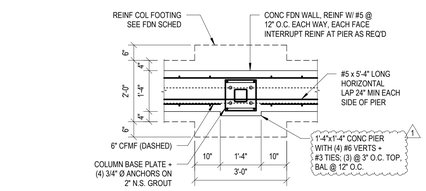
9 S4.01 GYM INTERIOR WALL FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



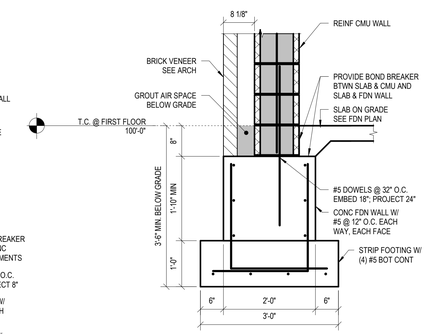
10 S4.01 TYPICAL INTERIOR BEARING WALL FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



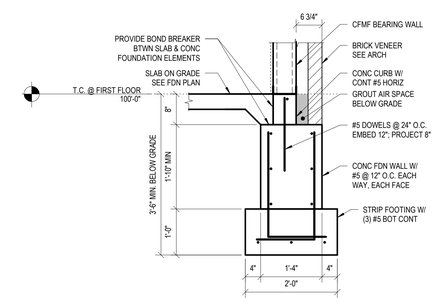
1 S4.01 GYM FOUNDATION PIER DETAIL
Scale: 1/2" = 1'-0"



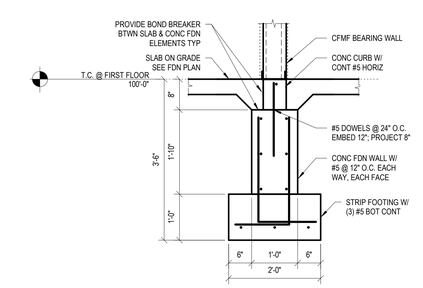
2 S4.01 NORTH WALL PIER DETAIL
Scale: 1/2" = 1'-0"



3 S4.01 GYM WALL FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



4 S4.01 TYPICAL EXTERIOR FOUNDATION DETAIL
Scale: 3/4" = 1'-0"



5 S4.01 INTERIOR BEARING WALL FOUNDATION AT UNITS 200/300/400
Scale: 3/4" = 1'-0"

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Bid Addendum 01	03/01/24

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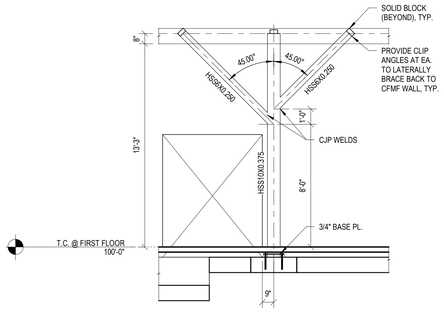
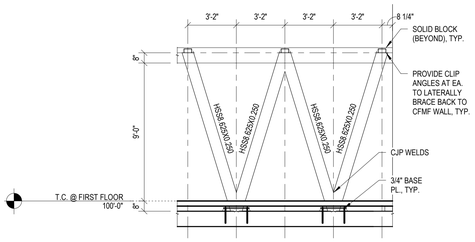
JOB NO. 2616.01A

SHEET TITLE
DETAILS

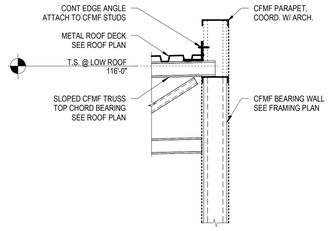
SHEET NO.
S4.01



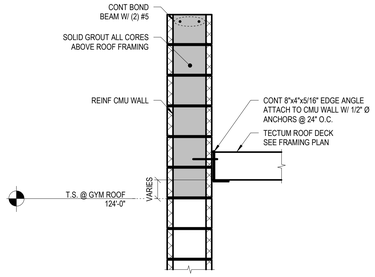
14 S4.02 CAFETERIA "TREE" ELEVATION
Scale: 1/4" = 1'-0"



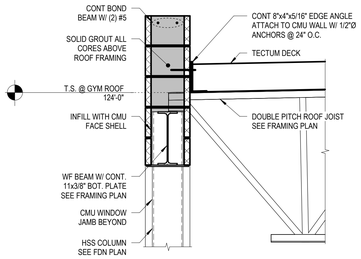
10 S4.02 INTERIOR "W" COLUMN ELEVATION
Scale: 1/4" = 1'-0"



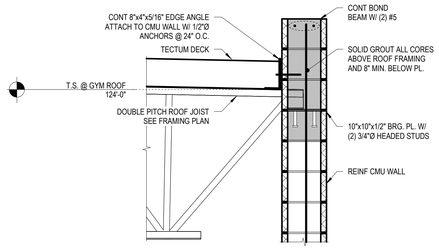
6 S4.02 TYPICAL ROOF DETAIL AT EXTERIOR CFMF WALL
Scale: 3/4" = 1'-0"



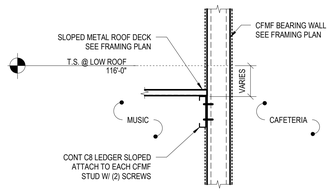
1 S4.02 GYM ROOF DETAIL PARALLEL TO FRAMING
Scale: 3/4" = 1'-0"



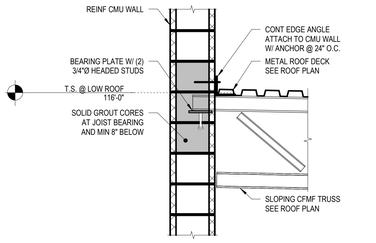
15 S4.02 GYM JOIST BEARING DETAIL AT WINDOW
Scale: 3/4" = 1'-0"



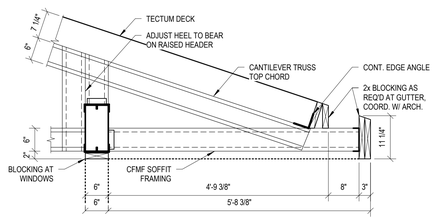
11 S4.02 GYM JOIST BEARING DETAIL AT CMU
Scale: 3/4" = 1'-0"



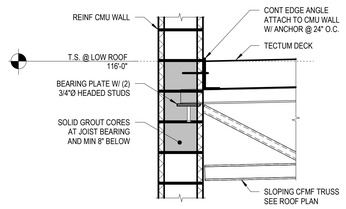
7 S4.02 ROOF DETAIL AT LOW ROOF INTERCHANGE
Scale: 3/4" = 1'-0"



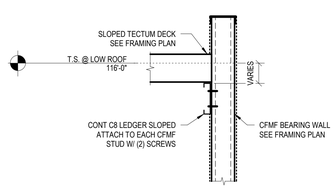
2 S4.02 ROOF DETAIL AT LOW ROOF & GYM INTERCHANGE
Scale: 3/4" = 1'-0"



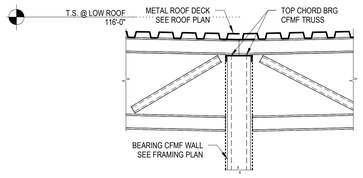
16 S4.02 SLOPED TRUSS TAIL DETAIL
Scale: 3/4" = 1'-0"



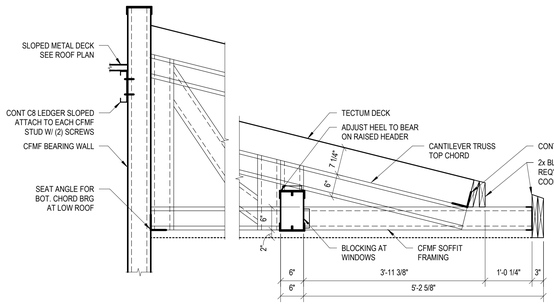
12 S4.02 TYPICAL JOIST BEARING DETAIL AT CMU
Scale: 3/4" = 1'-0"



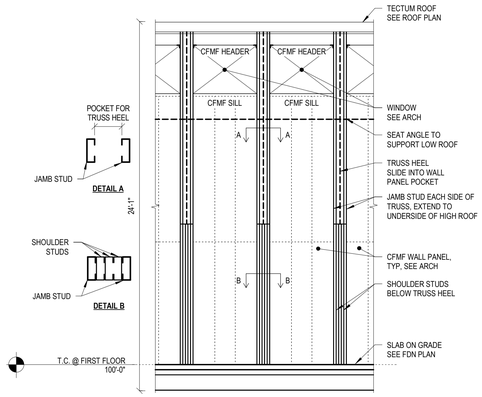
8 S4.02 ROOF DETAIL PARALLEL TO FRAMING UNITS 200, 300, 400
Scale: 3/4" = 1'-0"



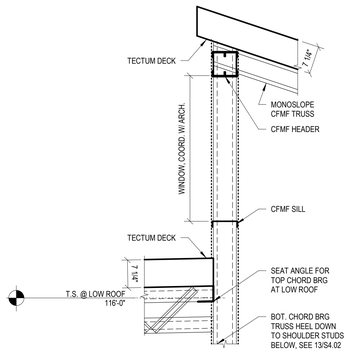
3 S4.02 TYPICAL ROOF DETAIL AT INTERIOR BEARING WALL
Scale: 3/4" = 1'-0"



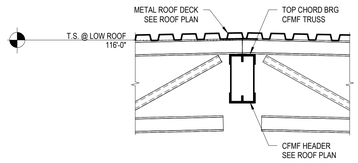
17 S4.02 SLOPED TRUSS DETAIL UNIT 100 SOUTH CANOPY
Scale: 3/4" = 1'-0"



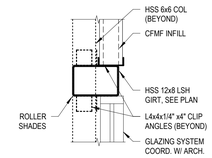
13 S4.02 TYPICAL WALL PANEL ELEVATION
Scale: 1/4" = 1'-0"



9 S4.02 HIGH WINDOW LINTEL DETAIL, UNIT 100
Scale: 3/4" = 1'-0"



4 S4.02 ROOF BEARING DETAIL AT HEADER
Scale: 3/4" = 1'-0"



5 S4.02 CAFETERIA SOUTH WALL HEADER DETAIL
Scale: 3/4" = 1'-0"

STATE OF MICHIGAN
BRAD CUTTER
ENGINEER
No. 6201063383
LICENSED PROFESSIONAL ENGINEER

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Design Development	08/18/23
Bid and Construction	01/26/24

RDA NO. 23008
LSD NO. SB-0059
JOB NO. 2616.01A

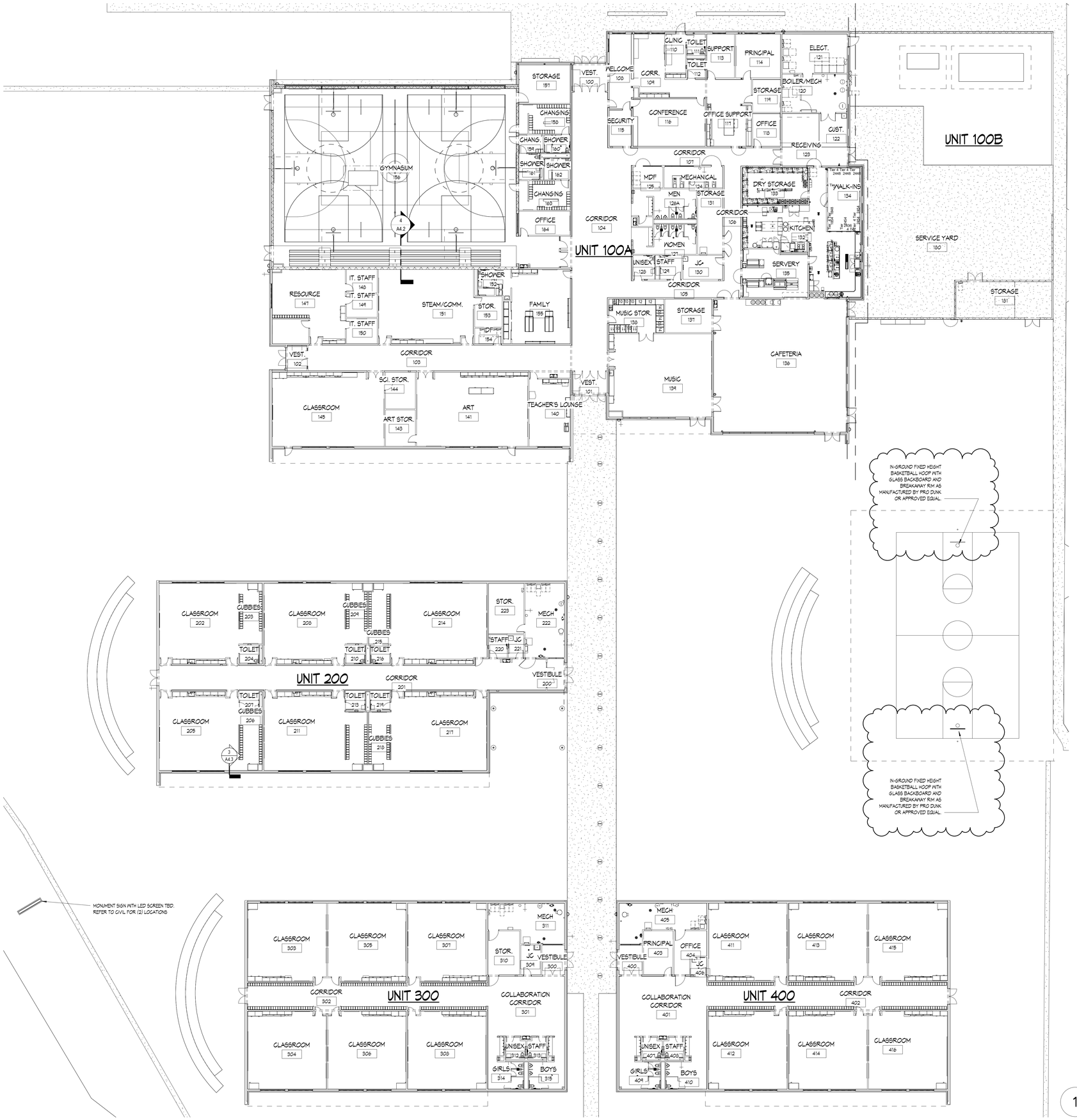
SHEET TITLE
DETAILS

SHEET NO.
S4.02

COMPOSITE PLAN GENERAL NOTES

NAME
101 INDICATES CONSTRUCTION DOCUMENT ROOM NUMBERS.

REFER TO CODE COMPLIANCE SHEETS FOR BUILDING CODE REQUIREMENTS.



1 COMPOSITE FLOOR PLAN
1/16" = 1'-0"

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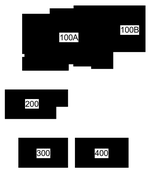
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
PR-01	04/19/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
COMPOSITE FLOOR PLAN

SHEET NO.
A0.1

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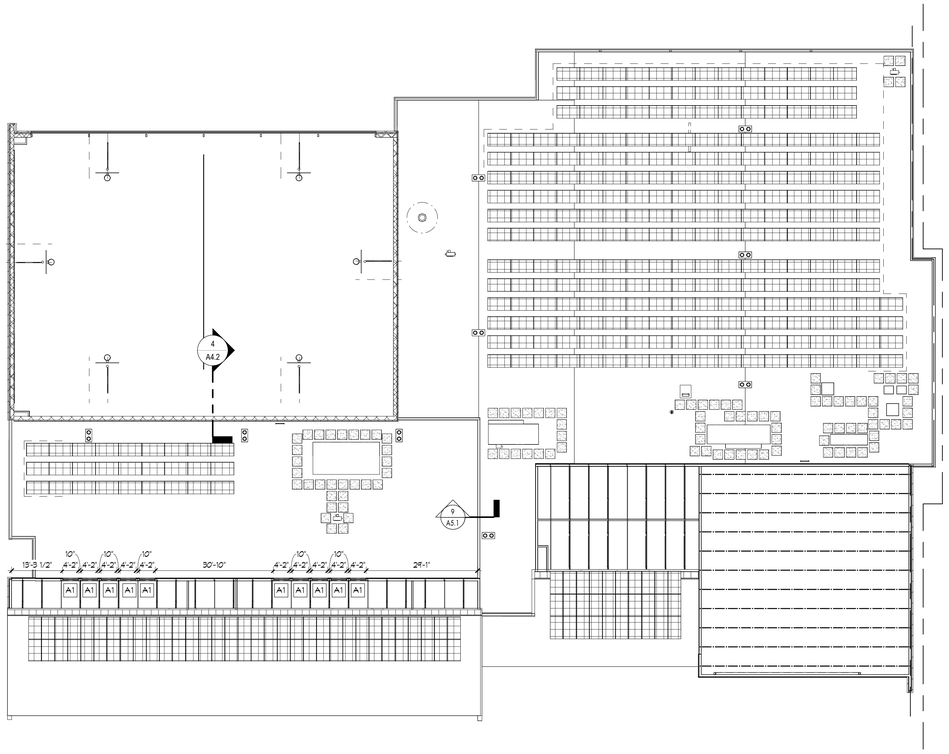

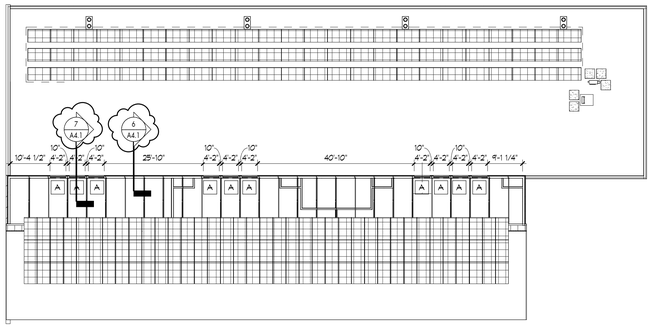

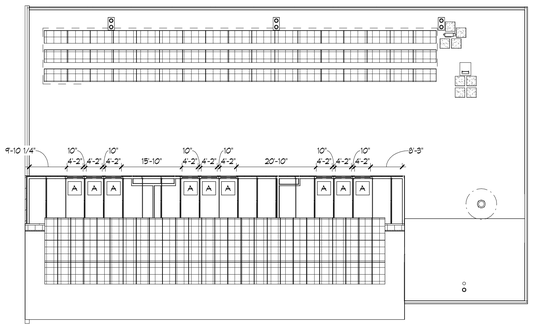

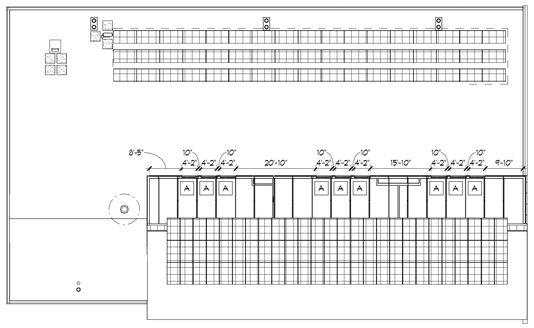

1 COMPOSITE CLERESTORY FLOOR PLAN
1/16" = 1'-0"

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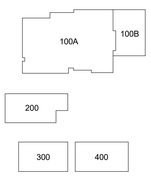
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE COMPOSITE CLERESTORY FLOOR PLAN

SHEET NO. A0.2

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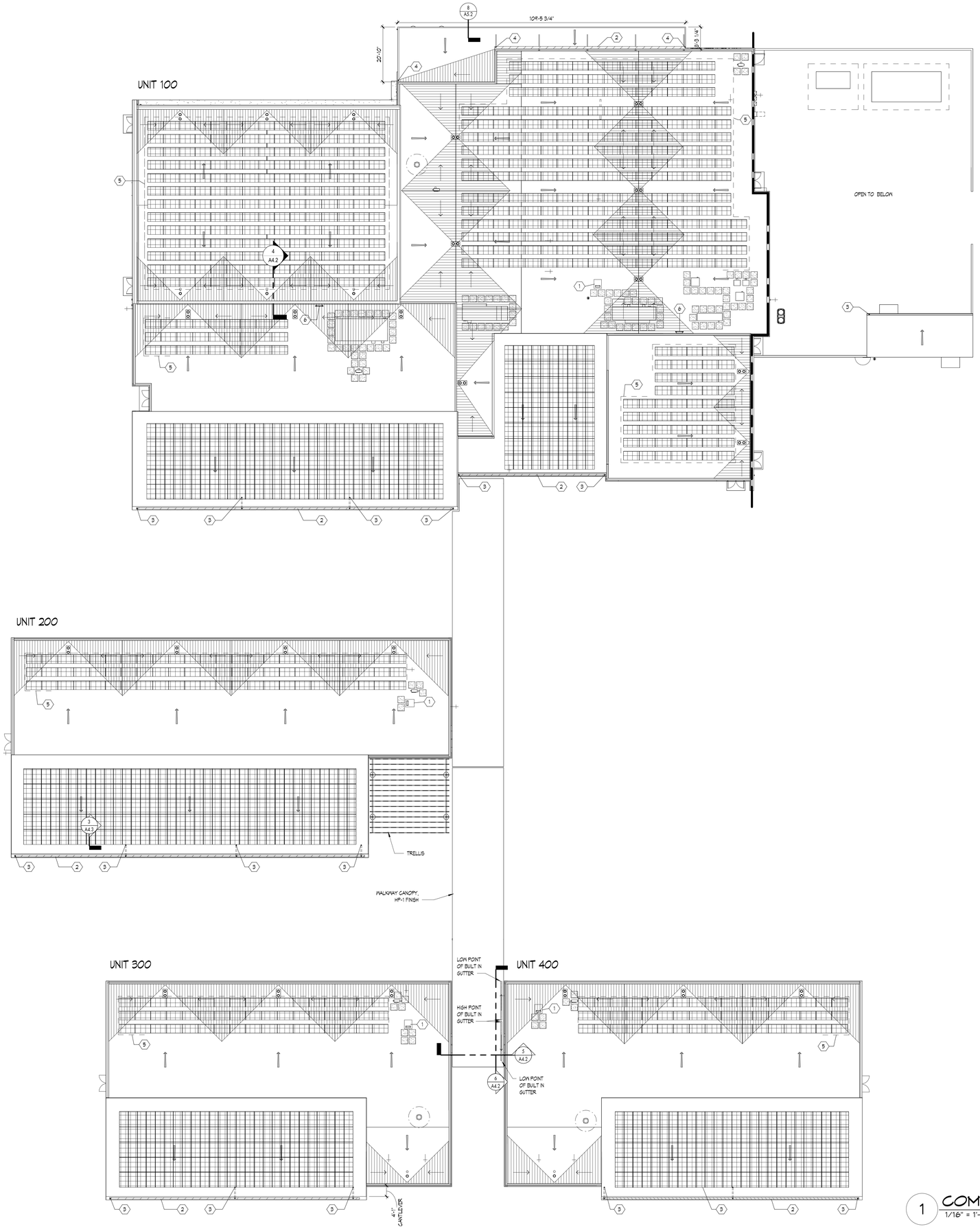

ROOF PLAN GENERAL NOTES

1. FOR MECHANICAL EQUIPMENT INSTALLED ON ROOF, CONTRACTOR SHALL INSTALL EQUIPMENT SUPPORTS, ROOF CURBS OR PADS AS REQUIRED TO POSITION EQUIPMENT THE REQUIRED DISTANCE ABOVE FINISHED ROOF SURFACE. SEE MECHANICAL PLANS FOR ROOF-MOUNTED EQUIPMENT. INSTALL NEW ROOF TOP EQUIPMENT PER EXISTING ROOF MANUFACTURERS INSTRUCTIONS TO MAINTAIN EXISTING WARRANTIES.
2. PROVIDE TREATED WOOD CURB RAILS ON WALK PADS FOR SMALL CONDENSER UNIT ASSOCIATED w/ FAN COIL UNITS. SEE MECHANICAL FOR LOCATIONS. SEE STRUCTURAL STANDARD DETAILING FOR PLACEMENT AND JOIST REINFORCEMENT.
3. ROOF SLOPES TO BE A MINIMUM OF 1/4" PER FOOT. TAPERED INSULATION ROOF SADDLES TO SLOPE TO ROOF DRAINS AS REQUIRED TO MAKE A COMPLETE SYSTEM OF 1/4" PER FOOT SLOPE.
4. TAPERED INSULATION INDICATED IS FOR DESIGN INTENT ONLY. ROOFING CONTRACTOR IS RESPONSIBLE FOR ALL SITE VERIFICATION AND FINAL INSULATION LAYOUTS TO ENSURE POSITIVE DRAINAGE. SUBMIT SHOP DRAWINGS OF TAPER AND INSULATION PLAN AT ALL NEW ROOF AREAS.
5. PROVIDE SINGLE MEMBRANE ROOFING COMPLETE WITH FLASHING AT CORNERS, COPING AND JUNCTIONS, U.N.O.
6. OVERFLOW DRAINS (OD) SHALL BE INSTALLED WITH INLET 2" ABOVE ROOF DRAIN (RD)

ROOF PLAN KEYNOTES

1. 3'-0" x 3'-0" ROOF ACCESS HATCH.
2. INTEGRAL GUTTER. REFER TO 2/A4.1.
3. DOWNSPOUT, TIE INTO STORM.
4. ENTRY CANOPY DOWNSPOUT, TIE INTO STORM.
5. HORIZONTAL FALL PROTECTION (DASH LINE). REFER TO STRUCT. FOR ANCHOR POINTS.
6. ROOF ACCESS LADDER, REFER TO DETAIL 11/A5.1.

ROOF PLAN LEGEND

- WALKWAY PADS
- COMBINATION ROOF DRAIN AND OVERFLOW DRAIN
- ROOF STRUCTURE SLOPE DIRECTION
- TAPERED INSULATION SLOPE DIRECTION
- BUILT-UP TAPERED INSULATION
- ROOFTOP SOLAR PANELS

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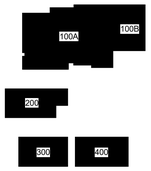
ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
ROOF COMPOSITE PLAN

SHEET NO.
A0.3

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1 COMPOSITE ROOF PLAN
1/16" = 1'-0"

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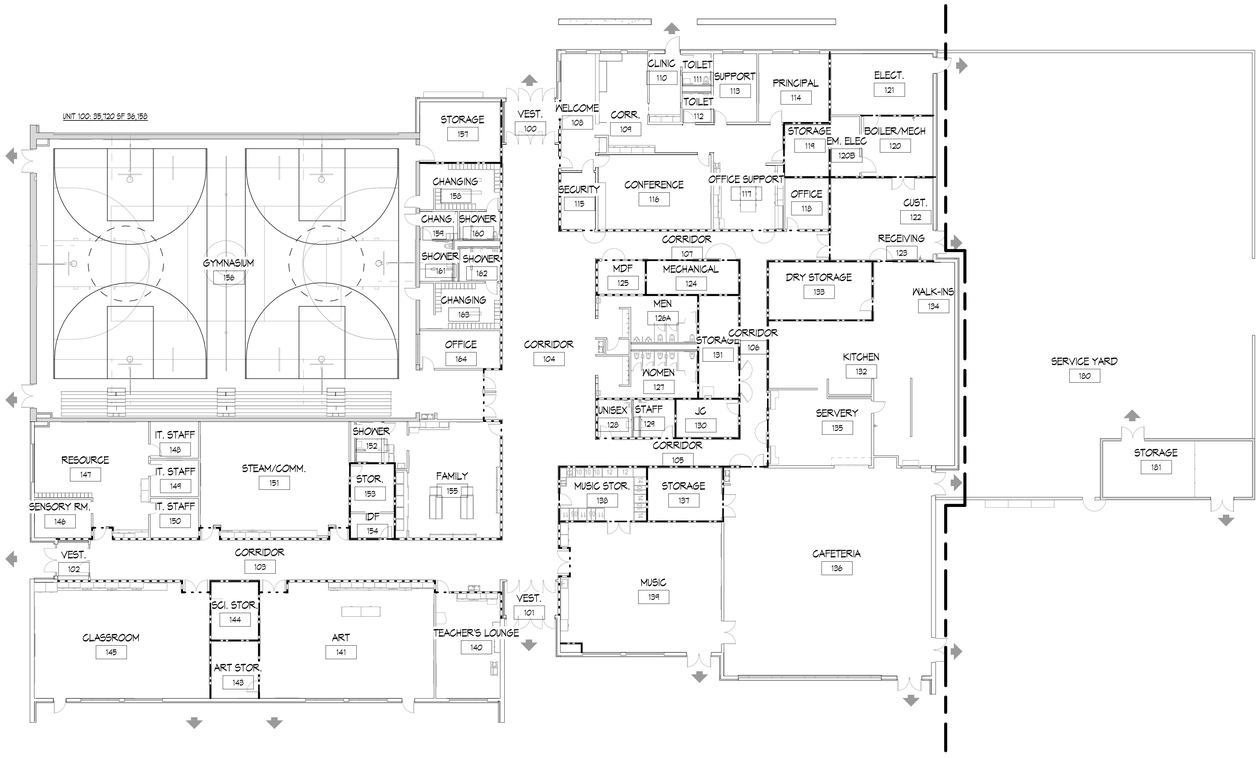

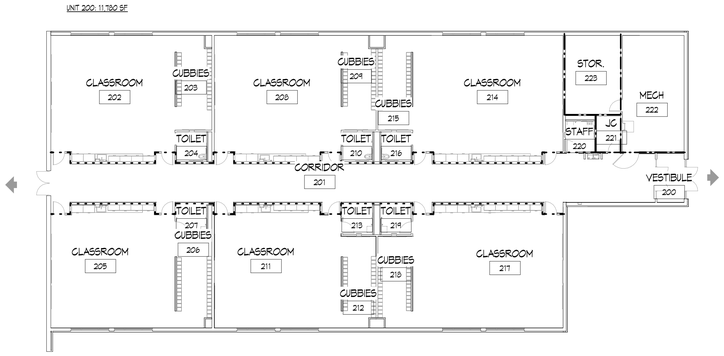

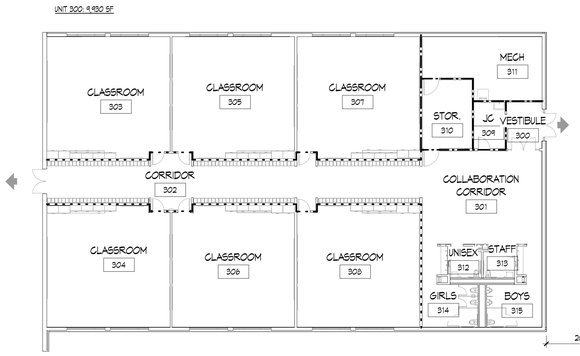

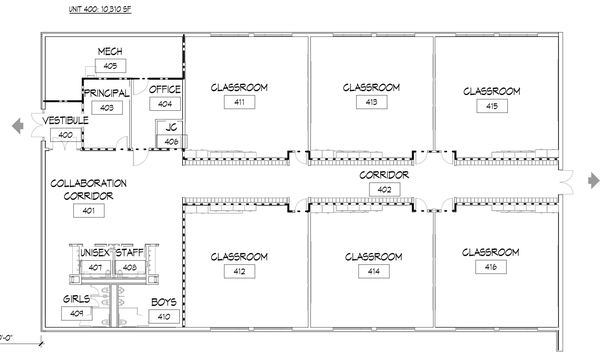

1 CODE COMPLIANCE PLAN
1/16" = 1'-0"

CODE COMPLIANCE LEGEND

- 1 HOUR FIRE RATED BARRIER. EXTEND TIGHT TO ROOF DECK. 45 MIN. OPENING ASSEMBLIES. SEALED PENETRATIONS.
- SMOKE PARTITION. EXTEND TIGHT TO ROOF DECK. OPENING PARTITIONS TO BE SMOKE TIGHT. SEALED PENETRATIONS.
- FIRE EXTINGUISHER / FIRE EXTINGUISHER CABINET. SEE SHEETS 1/A1.1A THRU A1.4 FOR LOCATIONS.
- EXIT
- NAME / XXX — ROOM NAME & ROOM NUMBER

GENERAL NOTES

1. CORRIDOR WALLS SHALL EXTEND TIGHT TO UNDERSIDE OF DECK TO RESIST THE PASSAGE OF SMOKE.
2. SEAL ALL PENETRATIONS AND OPENINGS IN FIRE RATED WALL CONSTRUCTION WITH FIRE RESISTANT RATED SEALANT AND / OR FIRE STOPPING TO MATCH WALL RATING AS INDICATED.

BUILDING CODE INFORMATION

RULES AND CODED:	MICHIGAN BUILDING CODE 2015 2012 NFPA 101 LIFE SAFETY CODE.
BARRIER FREE DESIGN:	MICHIGAN BUILDING CODE 2015 CHAPTER 11
PLUMBING CODE:	MICHIGAN PLUMBING CODE 2015
MECHANICAL CODE:	MICHIGAN MECHANICAL CODE 2015
ELECTRICAL CODE:	MICHIGAN ELECTRICAL CODE 2017
OCCUPANCY:	E (EDUCATIONAL)
CONSTRUCTION TYPE:	II B
NEW CONSTRUCTION:	FULLY SPRINKLERED

MEANS OF EGRESS REQUIREMENTS:

	ALLOWED
COMMON PATH (M.B.C. 1006.2.1): (NFPA 14.2.5.3)	75' - 0"
EXIT TRAVEL DIST. (N.F.P.A. 14.2.6.2): (MBC 1017.1.)	250'-0" (W/ FIRE SUPPRESSION) 150'-0" (W/O FIRE SUPPRESSION)
ALLOWABLE HEIGHT / AREA: MBC TABLES 504.3, 504.4, 506.2	3 STORIES / 43,500 S.F. PER FLOOR

AREA INCREASE (506.2.3 AND 506.3):
2,682 LF FRONTAGE > 30' OPEN
3122 L.F. TOTAL BUILDING PERMETER

((2,682/3,122) - .25) X 30/30 = .61

43,500 S.F. + (14,500 S.F. * .61) * 2 STORIES = 104,690 S.F.
WITH NO SINGLE STORY > 52,345 S.F.

TOTAL NEW CONSTRUCTION AREA: 67,215 S.F.

UNIT 100:
OCCUPANTS: 1435
AREA: 35,720 SF
BASE ALLOWABLE AREA (SPRINKLERED): 58,000 SF
*NO FIRE WALL REQUIRED DUE TO SPRINKLERS. CORRIDORS WALLS TO BE SMOKE PARTITIONS.

UNIT 200:
OCCUPANTS: 329
AREA: 11,555 SF
BASE ALLOWABLE AREA (SPRINKLERED): 58,000 SF
*NO FIRE WALL REQUIRED DUE TO SPRINKLERS. CORRIDORS WALLS TO BE SMOKE PARTITIONS.

UNIT 300:
OCCUPANTS: 303
AREA: 9,930 SF
BASE ALLOWABLE AREA (SPRINKLERED): 58,000 SF
*NO FIRE WALL REQUIRED DUE TO SPRINKLERS. CORRIDORS WALLS TO BE SMOKE PARTITIONS.

UNIT 400:
OCCUPANTS: 312
AREA: 10,160 SF
BASE ALLOWABLE AREA (SPRINKLERED): 58,000 SF
*NO FIRE WALL REQUIRED DUE TO SPRINKLERS. CORRIDORS WALLS TO BE SMOKE PARTITIONS.

SEPARATION OF BUILDING AREA: 2 HR.
MAX ALLOWABLE DEAD END CORRIDOR: 20 FEET

PLUMBING FIXTURE CALCULATIONS:

Unit 100 (1435 OCC):

	Occupants	WC/Urinals	Lavs	DF	Slop Sink
Gym F	335.5	5	2	1	0
Gym M	335.5	3	2	1	0
Cafe F	99.5	1	0	1	0
Cafe M	99.5	1	0	1	0
School F	282.5	6	6	3	1
School M	282.5	6	6	3	0
Total Female:		12	8	4	1
Total Male:		10	8	4	0

Unit 200 (329 OCC):

	Occupants	WC/Urinals	Lavs	DF	Slop Sink
School F	164.5	3	3	3	1
School M	164.5	3	3	0	0

Unit 300 (303 OCC):

	Occupants	WC/Urinals	Lavs	DF	Slop Sink
School F	154.5	3	3	3	1
School M	154.5	3	3	0	0

Unit 400 (312 OCC):

	Occupants	WC/Urinals	Lavs	DF	Slop Sink
School F	156	3	3	3	1
School M	156	3	3	0	0

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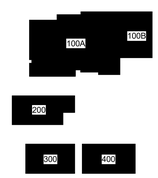
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
CODE COMPLIANCE PLAN

SHEET NO.
A0.4

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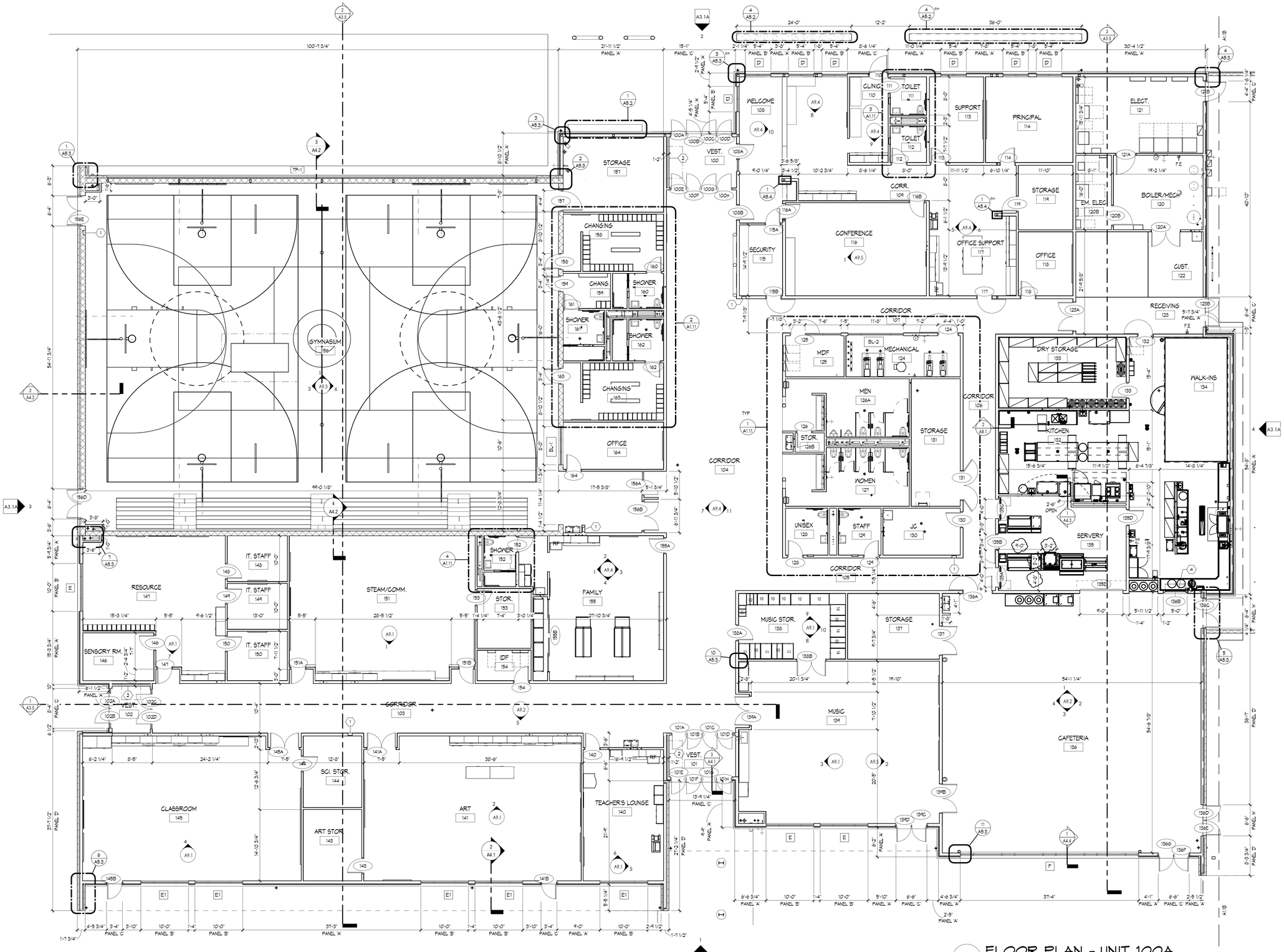
ARCHITECTURAL PLAN KEYNOTES

1. NEW FIRE EXTINGUISHER & EXTINGUISHER CABINET. REFER TO SPECIFICATION SECTION 104400.
2. 3-5/8" METAL STUD FURRED WALL WITH GYP ON ONE SIDE FOR RECESSED CABINET UNIT HEATER.
3. 4" CONCRETE EQUIPMENT HOUSEKEEPING PAD. REFER TO STRUCTURAL DRAWINGS & COORDINATE w/ MECHANICAL AND ELECTRICAL EQUIPMENT.
4. SLIP-IN CEILING COUNTER DOOR WITH INTEGRAL FRAME AND SILL. REFER TO SPEC SECTION 083323.

ARCHITECTURAL GENERAL NOTES

1. XX INDICATES CONSTRUCTION DOCUMENT ROOM NUMBERS.
2. REFER TO EQUIPMENT PLANS FOR CABINWORK, VISUAL DISPLAY BOARDS, LOCKERS, SHELVING, ETC.
3. REFER TO COLOR LAYOUT PLANS FOR FLOOR FINISH PATTERNS AND COLORS.
4. CONTRACTOR SHALL COORDINATE LOCATIONS OF FLOOR DRAINS, CLEAN OUTS, ETC, WITH APPROPRIATE TRADES.
5. REFER TO ENLARGED PLANS FOR ADDITIONAL NOTES AND DIMENSIONS.
6. MASONRY CONTRACTOR TO INSTALL LOOSE LINTELS FOR MISCELLANEOUS OPENINGS NOT INDICATED ON DRAWINGS BUT REQUIRED FOR MECHANICAL, ELECTRICAL, FOOD SERVICE EQUIPMENT OR OTHER ITEMS THAT PASS THROUGH A WALL. STEEL LINTELS SHALL BE SUPPLIED BY THE STEEL CONTRACTOR.
7. ALL PARTITION WALLS TO RUN TIGHT TO DECK, U.N.O.
8. REFER TO PARTITION TYPES SHOWN ON REFLECTED CEILING PLANS AND PARTITION TYPE SHEET A2.5 .
10. DIMENSIONS SHOWN ARE TO FACE OF WALL.
11. FILL/SEAL ALL PENETRATIONS THROUGH WALLS & VOIDS AT STRUCTURAL MEMBERS.
12. ALL EXPOSED C.M.U. CORNERS SHALL BE BULLNOSE CORNERS, U.N.O.
13. CAULK & SEAL AROUND ALL NEW CABINET HEATER LOUVERS INSTALLED IN EXTERIOR WALLS.
14. 3M SECURITY FILM - AT ALL EXTERIOR WINDOWS, 6FT AND BELOW OR FROM THE NEXT MULLION AFTER 6FT AND BELOW. REFER TO SPECIFICATION SECTION 088716.



1 FLOOR PLAN - UNIT 100A
1/8" = 1'-0"

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Willow School

Lansing School District

1012 W. Willow
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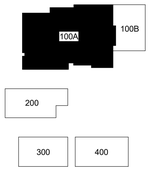

KEY PLAN

LSD SB-005
JOB 2616.01A

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SHEET TITLE
FLOOR PLAN - UNIT 100A

SHEET NO.
A1.1A

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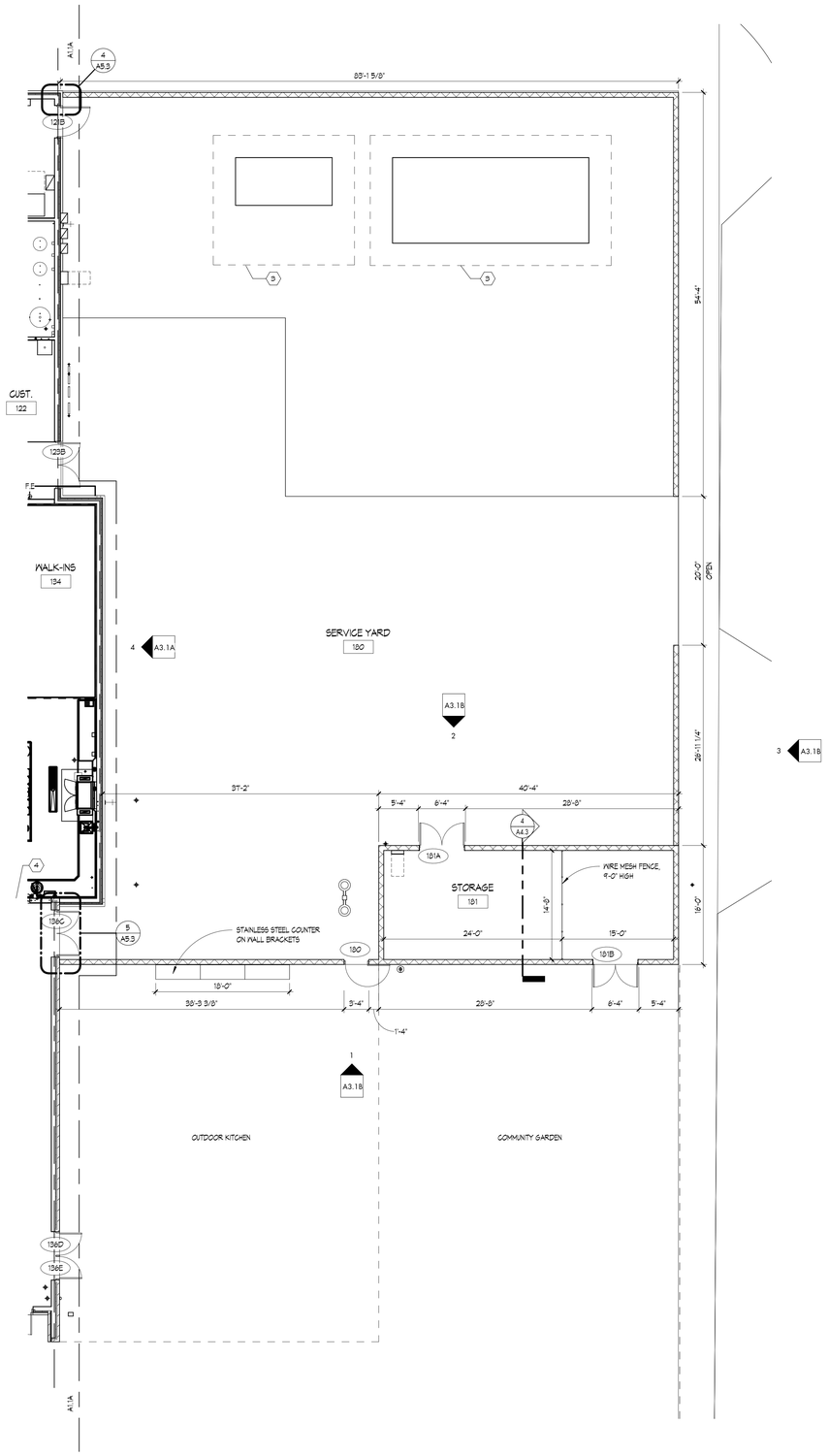


1 FLOOR PLAN - UNIT 100B

1/8" = 1'-0"

ARCHITECTURAL GENERAL NOTES

1. XX INDICATES CONSTRUCTION DOCUMENT ROOM NUMBERS.
2. REFER TO EQUIPMENT PLANS FOR CASEWORK, VISUAL DISPLAY BOARDS, LOCKERS, SHELVING, ETC.
3. REFER TO COLOR LAYOUT PLANS FOR FLOOR FINISH PATTERNS AND COLORS.
4. CONTRACTOR SHALL COORDINATE LOCATIONS OF FLOOR DRAINS, CLEAN OUTS, ETC, WITH APPROPRIATE TRADES.
5. REFER TO ENLARGED PLANS FOR ADDITIONAL NOTES AND DIMENSIONS.
6. MASONRY CONTRACTOR TO INSTALL LOOSE LINTELS FOR MISCELLANEOUS OPENINGS NOT INDICATED ON DRAWINGS BUT REQUIRED FOR MECHANICAL, ELECTRICAL, FOOD SERVICE EQUIPMENT OR OTHER ITEMS THAT PASS THROUGH A WALL. STEEL LINTELS SHALL BE SUPPLIED BY THE STEEL CONTRACTOR.
7. ALL PARTITION WALLS TO RUN TIGHT TO DECK, U.N.O.
8. REFER TO PARTITION TYPES SHOWN ON REFLECTED CEILING PLANS AND PARTITION TYPE SHEET A2.5 .
10 DIMENSIONS SHOWN ARE TO FACE OF WALL.
11. FILL/SEAL ALL PENETRATIONS THROUGH WALLS & VOIDS AT STRUCTURAL MEMBERS.
12. ALL EXPOSED C.M.U. CORNERS SHALL BE BULLNOSE CORNERS, U.N.O.
13. CAULK & SEAL AROUND ALL NEW CABINET HEATER LOUVERS INSTALLED IN EXTERIOR WALLS.
14. 3M SECURITY FILM - AT ALL EXTERIOR WINDOWS, 6FT AND BELOW OR FROM THE NEXT MULLION AFTER 6FT AND BELOW. REFER TO SPECIFICATION SECTION 083116.

ARCHITECTURAL PLAN KEYNOTES

1. NEW FIRE EXTINGUISHER & EXTINGUISHER CABINET. REFER TO SPECIFICATION SECTION 104400.
2. 3-5/8" METAL STUD FURRED WALL WITH GYP ON ONE SIDE FOR RECESSED CABINET UNIT HEATER.
3. 4" CONCRETE EQUIPMENT HOUSEKEEPING PAD. REFER TO STRUCTURAL DRAWINGS & COORDINATE W/ MECHANICAL AND ELECTRICAL EQUIPMENT.
4. SLIP-IN COILING COUNTER DOOR WITH INTEGRAL FRAME AND SILL. REFER TO SPEC SECTION 083323.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

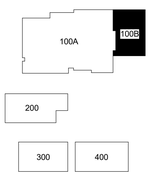
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

FLOOR PLAN - UNIT 100B

SHEET NO.

A1.1B

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ARCHITECTURAL PLAN KEYNOTES

1. NEW FIRE EXTINGUISHER & EXTINGUISHER CABINET. REFER TO SPECIFICATION SECTION 104400.
2. 3-5/8" METAL STUD FURRED WALL WITH GYP ON ONE SIDE FOR RECESSED CABINET UNIT HEATER.
3. 4" CONCRETE EQUIPMENT HOUSEKEEPING PAD. REFER TO STRUCTURAL DRAWINGS & COORDINATE W/ MECHANICAL AND ELECTRICAL EQUIPMENT.
4. SLIP-IN CEILING COUNTER DOOR WITH INTEGRAL FRAME AND SILL. REFER TO SPEC SECTION 083323.

ARCHITECTURAL GENERAL NOTES

1. XX INDICATES CONSTRUCTION DOCUMENT ROOM NUMBERS.
2. REFER TO EQUIPMENT PLANS FOR CASEWORK, VISUAL DISPLAY BOARDS, LOCKERS, SHELVING, ETC.
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5. REFER TO ENLARGED PLANS FOR ADDITIONAL NOTES AND DIMENSIONS.
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7. ALL PARTITION WALLS TO RUN TIGHT TO DECK, U.N.O.
8. REFER TO PARTITION TYPES SHOWN ON REFLECTED CEILING PLANS AND PARTITION TYPE SHEET A2.5 .
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11. FILL/SEAL ALL PENETRATIONS THROUGH WALLS & VOIDS AT STRUCTURAL MEMBERS.
12. ALL EXPOSED C.M.U. CORNERS SHALL BE BULLNOSE CORNERS, U.N.O.
13. CAULK & SEAL AROUND ALL NEW CABINET HEATER LOUVERS INSTALLED IN EXTERIOR WALLS.
14. 3M SECURITY FILM - AT ALL EXTERIOR WINDOWS, 6FT AND BELOW OR FROM THE NEXT MULLION AFTER 6FT AND BELOW. REFER TO SPECIFICATION SECTION 088716.

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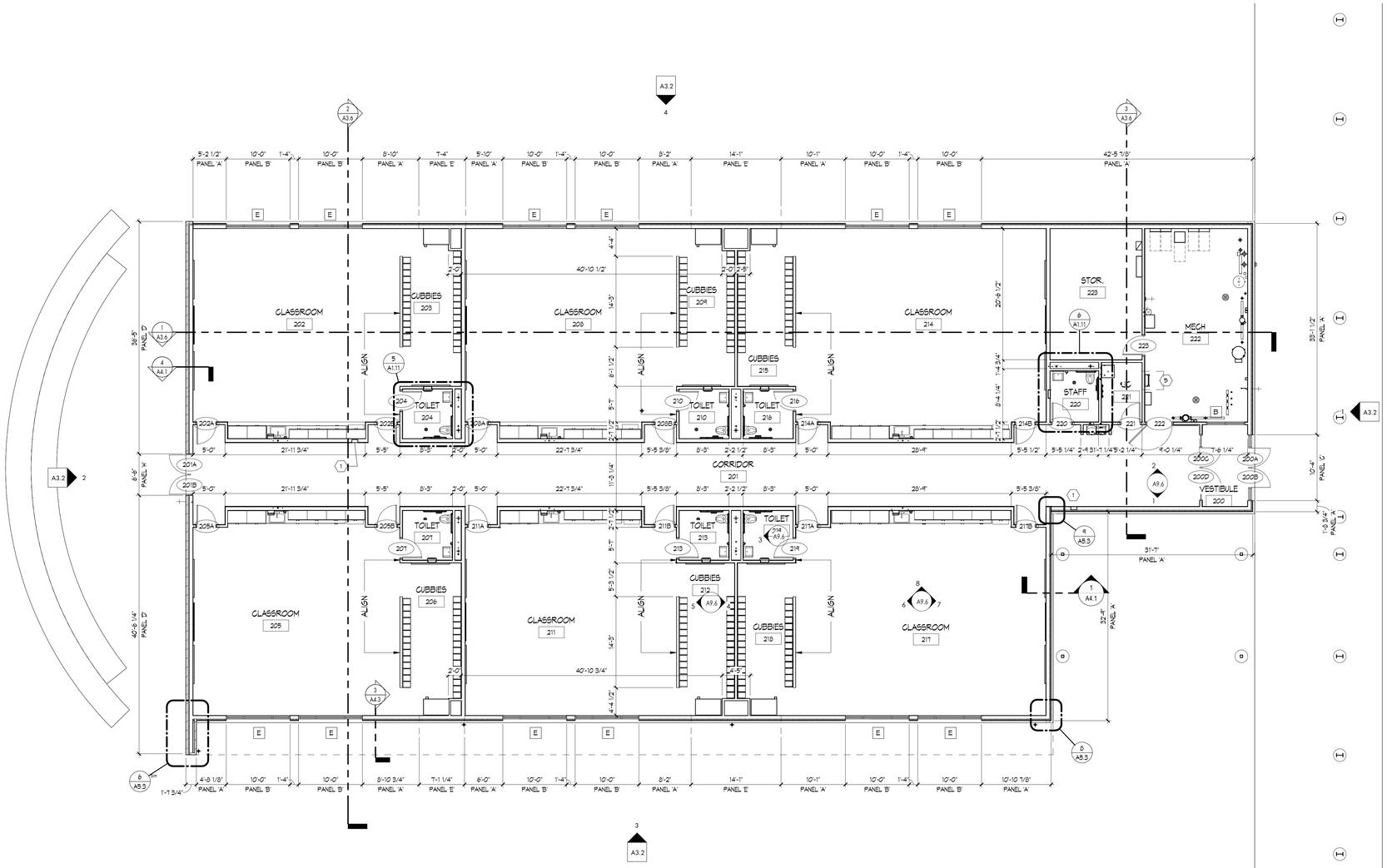


1 FLOOR PLAN - UNIT 200
1/8" = 1'-0"

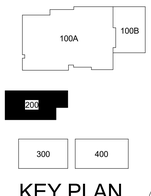
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
FLOOR PLAN - UNIT 200

SHEET NO.
A1.2

KINGSCOTT ASSOCIATES INC. KALAMAZOO, MICHIGAN

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ARCHITECTURAL PLAN KEYNOTES

1. NEW FIRE EXTINGUISHER & EXTINGUISHER CABINET. REFER TO SPECIFICATION SECTION 104400.
2. 3-5/8" METAL STUD FURRED WALL WITH GYP ON ONE SIDE FOR RECESSED CABINET UNIT HEATER.
3. 4" CONCRETE EQUIPMENT HOUSEKEEPING PAD. REFER TO STRUCTURAL DRAWINGS & COORDINATE W/ MECHANICAL AND ELECTRICAL EQUIPMENT.
4. SLIP-IN CEILING COUNTER DOOR WITH INTEGRAL FRAME AND SILL. REFER TO SPEC SECTION 083323.

ARCHITECTURAL GENERAL NOTES

1. XX INDICATES CONSTRUCTION DOCUMENT ROOM NUMBERS.
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5. REFER TO ENLARGED PLANS FOR ADDITIONAL NOTES AND DIMENSIONS.
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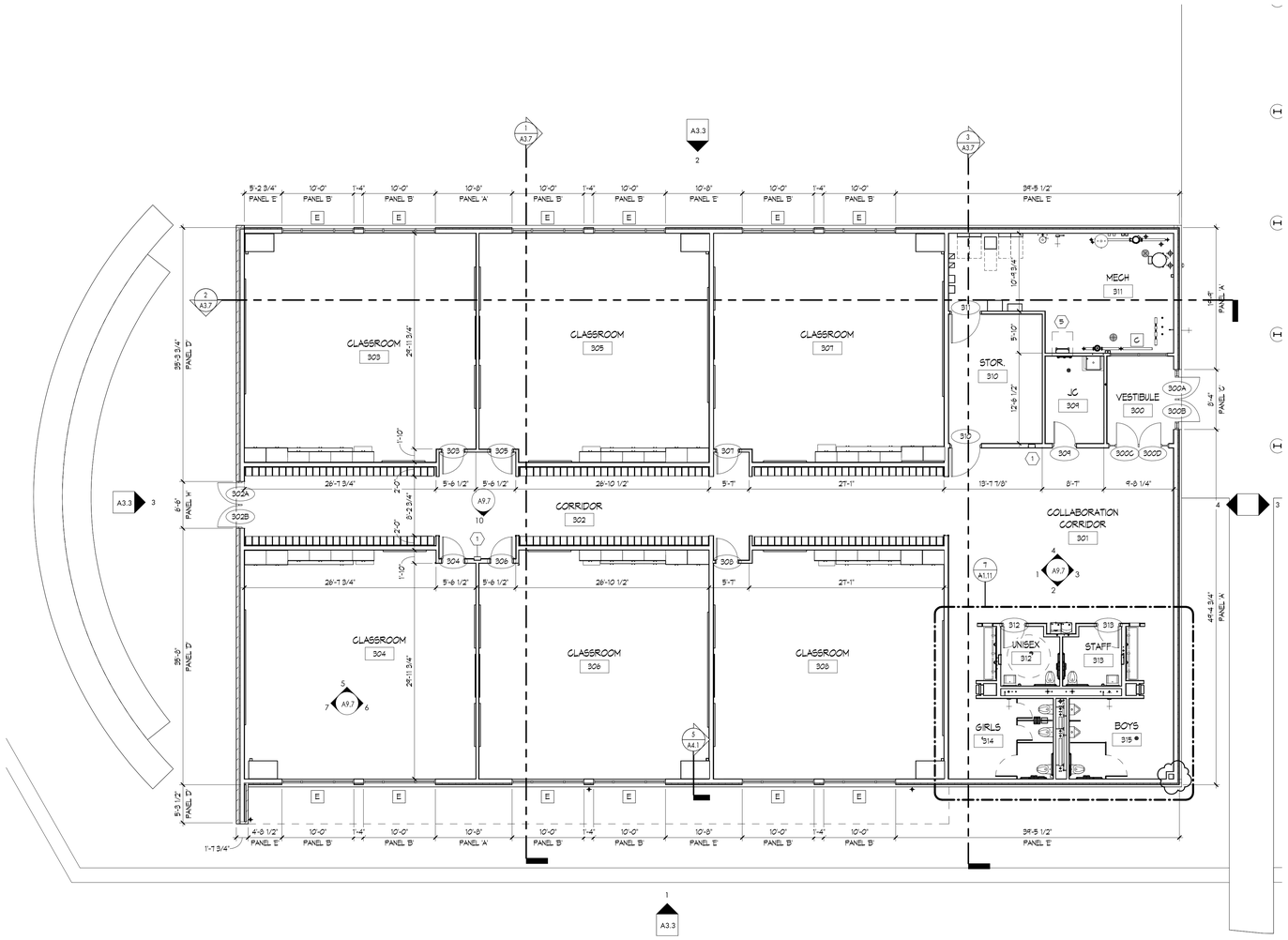
13. CAULK & SEAL AROUND ALL NEW CABINET HEATER LOUVERS INSTALLED IN EXTERIOR WALLS.
14. 3M SECURITY FILM - AT ALL EXTERIOR WINDOWS, 6FT AND BELOW OR FROM THE NEXT MULLION AFTER 6FT AND BELOW. REFER TO SPECIFICATION SECTION 088716.



1 FLOOR PLAN - UNIT 300
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

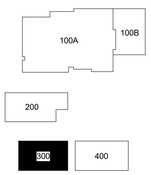
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
FLOOR PLAN - UNIT 300

SHEET NO.
A1.3

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ARCHITECTURAL PLAN KEYNOTES

1. NEW FIRE EXTINGUISHER & EXTINGUISHER CABINET. REFER TO SPECIFICATION SECTION 104400.
2. 3-5/8" METAL STUD FURRED WALL WITH GYP ON ONE SIDE FOR RECESSED CABINET UNIT HEATER.
3. 4" CONCRETE EQUIPMENT HOUSEKEEPING PAD. REFER TO STRUCTURAL DRAWINGS & COORDINATE W/ MECHANICAL AND ELECTRICAL EQUIPMENT.
4. SLIP-IN CEILING COUNTER DOOR WITH INTEGRAL FRAME AND SILL. REFER TO SPEC SECTION 083323.

ARCHITECTURAL GENERAL NOTES

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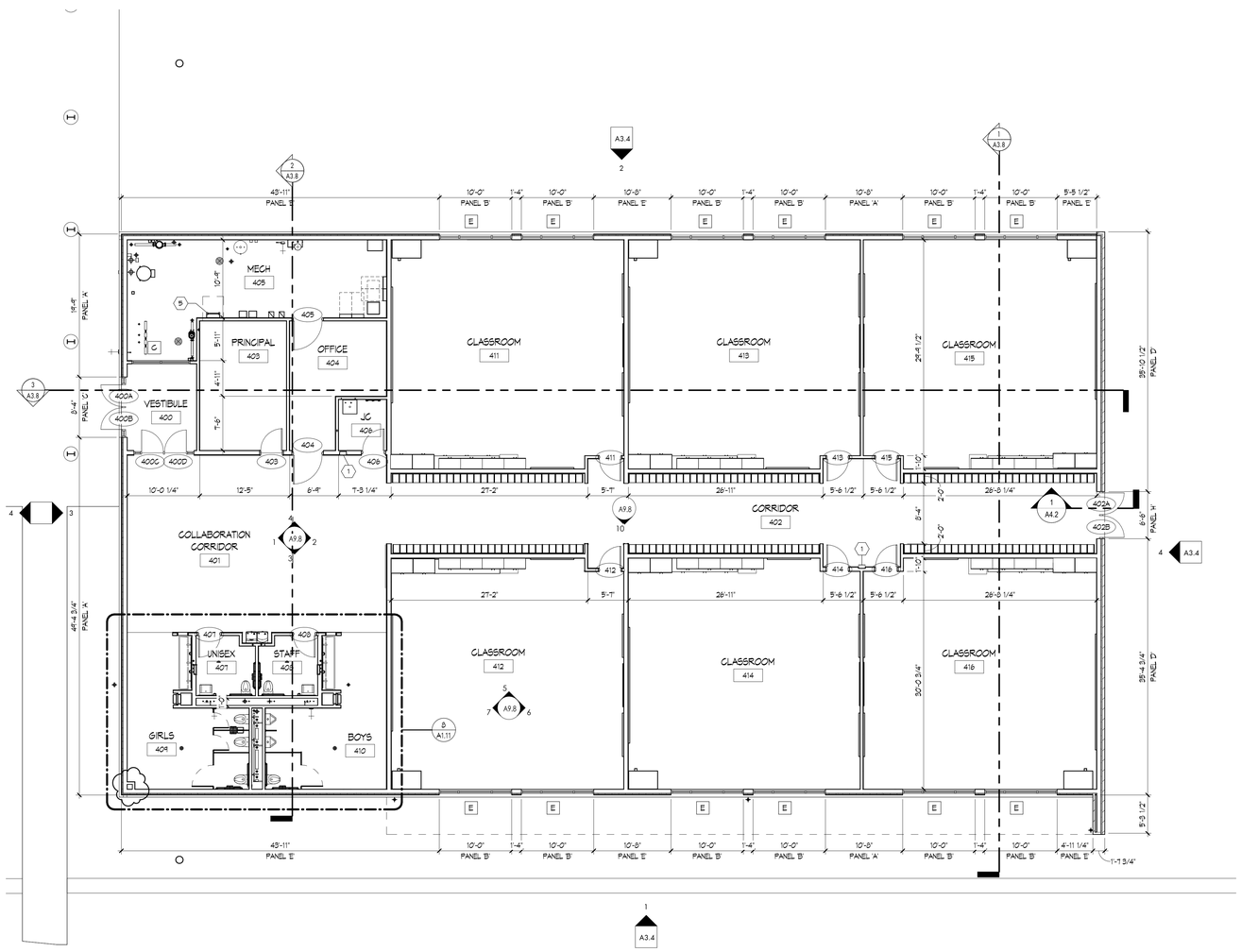
14. 3M SECURITY FILM - AT ALL EXTERIOR WINDOWS, 6FT AND BELOW OR FROM THE NEXT MULLION AFTER 6FT AND BELOW. REFER TO SPECIFICATION SECTION 088116.



1 FLOOR PLAN - UNIT 400

1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

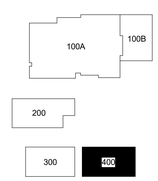
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

N

LSD SB-005
JOB 2616.01A

SHEET TITLE
FLOOR PLAN - UNIT 400

SHEET NO.
A1.4

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EQUIPMENT PLAN GENERAL NOTES

1. WALL CABINET TOPS TO BE AT 84" A.F.F. UNLESS NOTED OTHERWISE.
2. FILLER = PROVIDE FACE, TOP, BOTTOM AND/OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET.
3. ALL VISUAL DISPLAY BOARD INSTALLATION LOCATIONS ARE TO BE FIELD VERIFIED PRIOR TO INSTALLATION
4. REFER TO SPECIFICATIONS FOR VISUAL DISPLAY BOARD FINISHES AND COLOR DESIGNATIONS.
5. HOLD ALL TALL CABINETS ADJACENT TO BASE CABINETS OUT 1" FROM WALL OR FLUSH WITH THE FRONT EDGE OF THE COUNTERTOP. PROVIDE FILLER AT BACK WALL AS REQUIRED.
6. ALL BASE CABINETS SHALL HAVE COUNTERTOPS WITH BACK AND SIDE SPLASH. REFER TO **DIVISION 12 SPECIFICATIONS.**
7. ALL COUNTERTOPS SHALL HAVE RADIUS CORNERS AT OUTSIDE CORNERS.
8. REFER TO SPECIFICATION **SECTION 122413** FOR DETAILED INFORMATION ON WINDOW ROLLER SHADES.
9. SEE SHEET A1.10 FOR SIGNAGE DETAILS. PROVIDE BACK PANELS AT ALL SIGNAGE MOUNTED ON GLASS.
10. TRIM WALL PROTECTION AROUND POWER/DATA OUTLETS (TYP.)
11. SEE SHEET A1.9 FOR VISUAL DISPLAY SCHEDULE.
12. REFER TO TECHNOLOGY DRAWINGS BY OTHERS TO COORDINATE VDB's. INFORM ARCHITECT OF CONFLICTS.

EQUIPMENT PLAN LEGEND

X-X = INDICATES CASEWORK. REFER TO SPECIFICATION SECTION 123216 FOR SCHEDULE AND PLASTIC LAMINATE SELECTIONS. ALL CABINETS SHALL SLOPED TOPS AND ALL DOORS SHALL HAVE LOCKS U.N.O.

B-_# = BASE CABINET
W-_# = WALL CABINET
T-_# = TALL CABINET
FILLER = PROVIDE FACE, TOP, BOTTOM AND / OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET

RS-# = ROLLER SHADE, SPECIFICATION SECTION 122413

= SIGNS (FOR TYPES AND MOUNTING, SEE SHEET A1.25 AND SPEC SECTION 101419, 101423 & 101424

VDB-_# = VISUAL DISPLAY BOARD, SPECIFICATION SECTION 101100

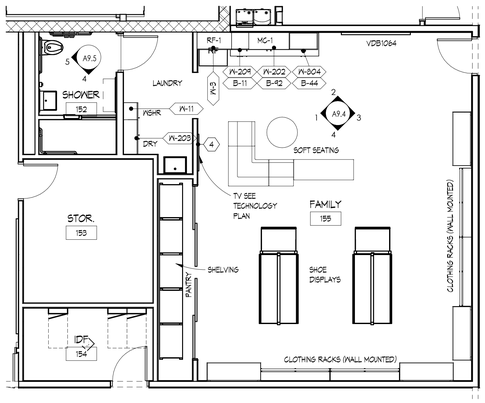
APPLIANCE PLAN LEGEND

SEE SPEC. SECTION 113013

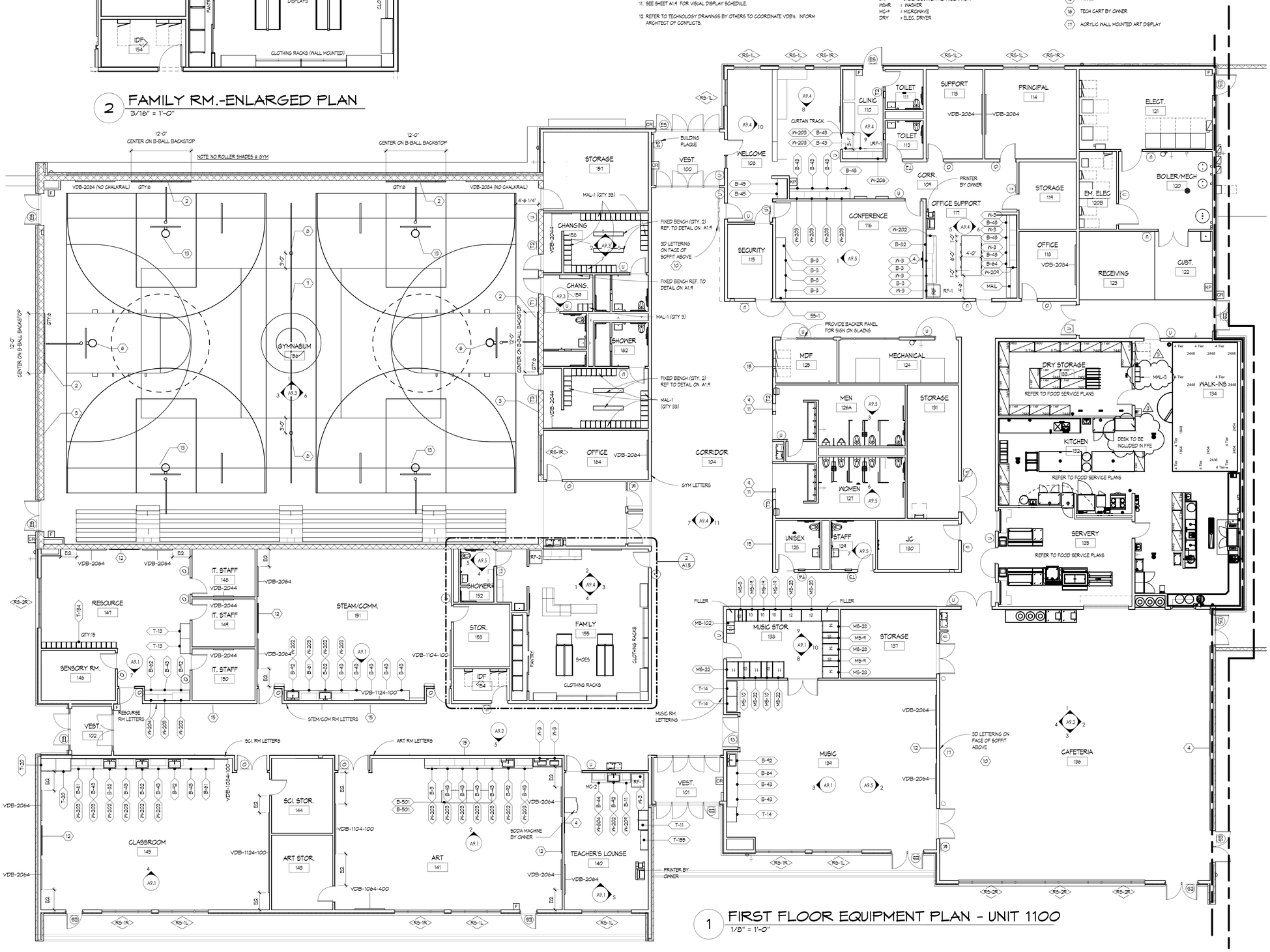
RF-# = REFRIGERATOR
URF-# = UNDERCOUNTER REFRIGERATOR
WSHR = WASHER
MC-# = MICROWAVE
DRY = ELEC. DRYER

EQUIPMENT PLAN NEYNOTES

1. CASEWORK FILLER TYP
2. GYM WALL PADS, 2' W X 8' H X 2" THICK, MOUNTED AT 4" AFF, REFER TO SPECIFICATION SECTION 116623
3. GYM SCOREBOARD. REFER TO SPECIFICATION SECTION 116623
4. FLAT SCREEN TV, SEE TECHNOLOGY DRAWINGS
5. SHORT THROUGH PROJECTOR BY TECHNOLOGY CONSULTANT
6. SIDE RETRACTABLE BASKETBALL BACKSTOP (GLASS) SEE SPECIFICATION SECTION 116623
7. GYMNASIUM DIVIDER, SEE SPEC SECTION 083513
8. VOLLEYBALL SLEEVE, REFER TO SPECIFICATION SECTION 116623
9. FRAME OUT OPENING WITH WOOD TRIM AND PAINT SAME COLOR AS WALL
10. ARCHITECTURAL LETTERS, SEE INTERIOR ELEVATIONS AND SHEET A1.10
11. GLASS N OPENING WITH FROSTED BOY/GIRL SYMBOL, SEE SHEET A1.10
12. WALL MOUNTED INTERACTIVE TOUCH SCREEN, SEE TECHNOLOGY PLAN
13. FORWARD RETRACTABLE BASKETBALL BACKSTOP (GLASS) SEE SPECIFICATION SECTION 116623
14. TECH CART BY OWNER
15. ACRYLIC WALL MOUNTED ART DISPLAY



2 FAMILY RM.-ENLARGED PLAN
3/16" = 1'-0"



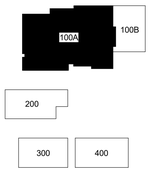
1 FIRST FLOOR EQUIPMENT PLAN - UNIT 1100
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 01	03/01/2024
Addendum 03	03/15/2024



KEY PLAN
LSD SB-005
JOB 2616.01A
N

SHEET TITLE
EQUIPMENT PLAN - UNIT 100

SHEET NO.
A1.5

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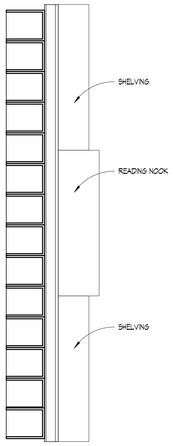
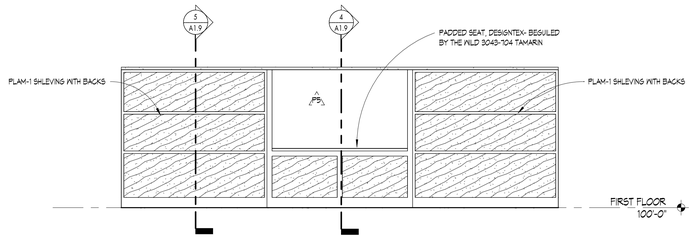
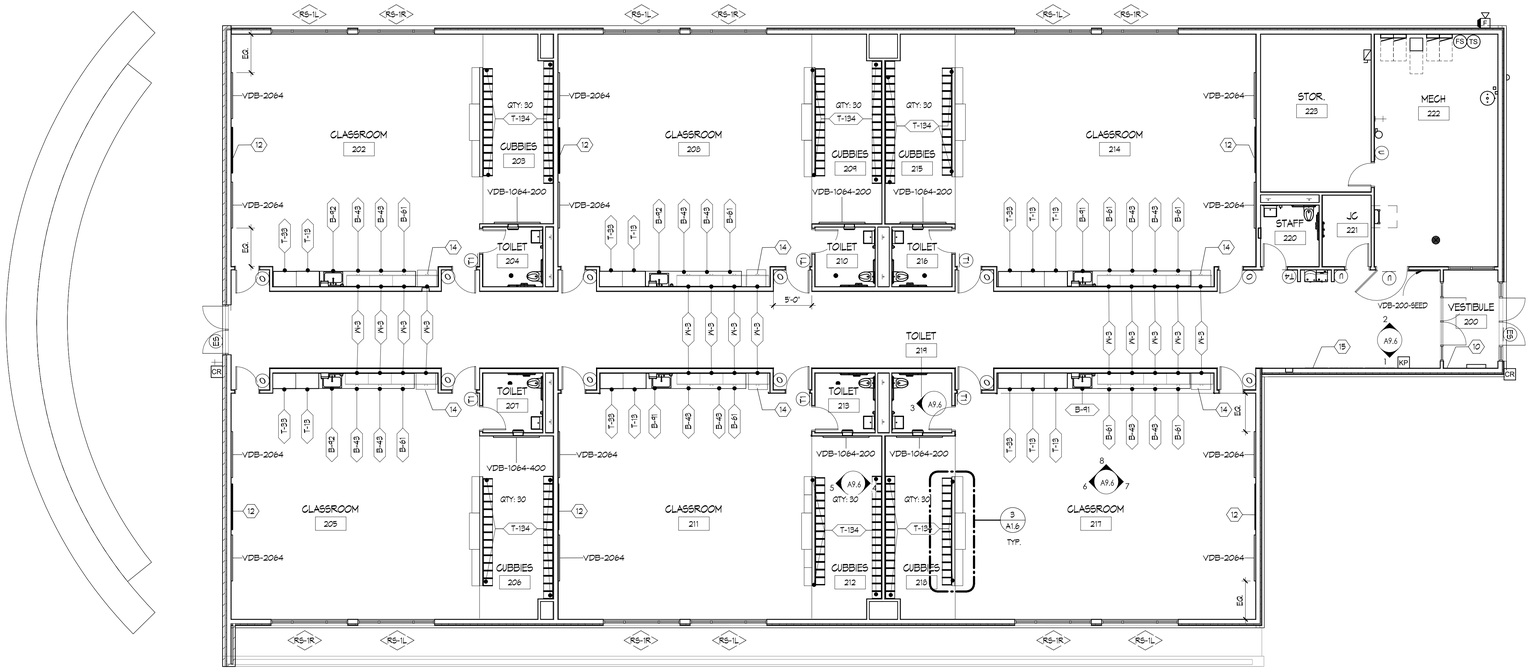


3 ENLARGED PLAN-READING NOOK
1/2" = 1'-0"



2 ELEVATION-READING NOOK
1/2" = 1'-0"



1 EQUIPMENT PLAN - UNIT 200
1/8" = 1'-0"

EQUIPMENT PLAN GENERAL NOTES

1. WALL CABINET TOPS TO BE AT 84" A.F.F. UNLESS NOTED OTHERWISE.
2. FILLER = PROVIDE FACE, TOP, BOTTOM AND/OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET.
3. ALL VISUAL DISPLAY BOARD INSTALLATION LOCATIONS ARE TO BE FIELD VERIFIED PRIOR TO INSTALLATION
4. REFER TO SPECIFICATIONS FOR VISUAL DISPLAY BOARD FINISHES AND COLOR DESIGNATIONS.
5. HOLD ALL TALL CABINETS ADJACENT TO BASE CABINETS OUT 1" FROM WALL OR FLUSH WITH THE FRONT EDGE OF THE COUNTERTOP. PROVIDE FILLER AT BACK WALL AS REQUIRED.
6. ALL BASE CABINETS SHALL HAVE COUNTERTOPS WITH BACK AND SIDE SPLASH. REFER TO **DIVISION 12 SPECIFICATIONS**.
7. ALL COUNTERTOPS SHALL HAVE RADIUS CORNERS AT OUTSIDE CORNERS.
8. REFER TO SPESIFICATION **SECTION 122413** FOR DETAILED INFORMATION ON WINDOW ROLLER SHADES.
9. SEE SHEET A1.10 FOR SIGNAGE DETAILS. PROVIDE BACK PANELS AT ALL SIGNAGE MOUNTED ON GLASS.
10. TRIM WALL PROTECTION AROUND POWER/DATA OUTLETS (TYP.)
11. SEE SHEET A1.9 FOR VISUAL DISPLAY SCHEDULE.
12. REFER TO TECHNOLOGY DRAWINGS BY OTHERS TO COORDINATE VDB's. INFORM ARCHITECT OF CONFLICTS.

EQUIPMENT PLAN LEGEND

X-X = INDICATES CASEWORK. REFER TO SPECIFICATION SECTION 123216 FOR SCHEDULE AND PLASTIC LAMINATE SELECTIONS. ALL CABINETS SHALL SLOPED TOPS AND ALL DOORS SHALL HAVE LOCKS U.N.O.

B-_# = BASE CABINET
W-_# = WALL CABINET
T-_# = TALL CABINET
FILLER = PROVIDE FACE, TOP, BOTTOM AND / OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET

RS-# = ROLLER SHADE, SPECIFICATOIN SECTION 122413

= SIGNS (FOR TYPES AND MOUNTING, SEE SHEET A1.25 AND SPEC SECTION 101419, 101423 & 101424

VDB-_# = VISUAL DISPLAY BOARD, SPECIFICATION SECTION 101100

APPLIANCE PLAN LEGEND

SEE SPEC. SECTION 113013

RF-# = REFRIGERATOR
URF-# = UNDERCOUNTER REFRIGERATOR
WSHR = WASHER
MC-# = MICROWAVE
DRY = ELEC. DRYER

EQUIPMENT PLAN NEYNOTES

1. CASEWORK FILLER TYP
2. GYM WALL PADS, 2' W X 8' H X 2" THICK, MOUNTED AT 4" AFF. REFER TO SPECIFICATION SECTION 116623
3. GYM SCOREBOARD. REFER TO SPECIFICATION SECTION 116623
4. FLAT SCREEN TV, SEE TECHNOLOGY DRAWINGS
5. SHORT THROUGH PROJECTOR BY TECHNOLOGY CONSULTANT
6. SIDE RETRACTABLE BASKETBALL BACKSTOP (GLASS) SEE SPECIFICATION SECTION 116623
7. GYMNASIUM DIVIDER, SEE SPEC SECTION 083513
8. VOLLEYBALL SLEEVE, REFER TO SPECIFICATION SECTION 116623
9. FRAME OUT OPENING WITH WOOD TRIM AND PAINT SAME COLOR AS WALL
10. ARCHITECTURAL LETTERS, SEE INTERIOR ELEVATIONS AND SHEET A1.10
11. GLASS IN OPENING WITH FROSTED BOY/GIRL SYMBOL, SEE SHEET A1.10
12. WALL MOUNTED INTERACTICE TOUCH SCREEN, SEE TECHNOLOGY PLAN
13. FORWARD RETRACTABLE BASKETBALL BACKSTOP (GLASS) SEE SPECIFICATION SECTION 116623
14. TECH CART BY OWNER
15. ACRYLIC WALL MOUNTED ART DISPLAY
16. FLAT PANEL INFOGRAPHIC
17. PROJECTOR SCREEN, SEE TECHNOLOGY PLAN

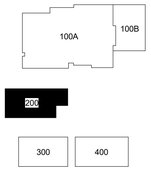
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
EQUIPMENT PLAN - UNIT 200

SHEET NO.
A1.6

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EQUIPMENT PLAN GENERAL NOTES

1. WALL CABINET TOPS TO BE AT 84" A.F.F. UNLESS NOTED OTHERWISE.
2. FILLER = PROVIDE FACE, TOP, BOTTOM AND/OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET.
3. ALL VISUAL DISPLAY BOARD INSTALLATION LOCATIONS ARE TO BE FIELD VERIFIED PRIOR TO INSTALLATION
4. REFER TO SPECIFICATIONS FOR VISUAL DISPLAY BOARD FINISHES AND COLOR DESIGNATIONS.
5. HOLD ALL TALL CABINETS ADJACENT TO BASE CABINETS OUT 1" FROM WALL OR FLUSH WITH THE FRONT EDGE OF THE COUNTERTOP. PROVIDE FILLER AT BACK WALL AS REQUIRED.
6. ALL BASE CABINETS SHALL HAVE COUNTERTOPS WITH BACK AND SIDE SPLASH. REFER TO **DIVISION 12 SPECIFICATIONS**.
7. ALL COUNTERTOPS SHALL HAVE RADIUS CORNERS AT OUTSIDE CORNERS.
8. REFER TO SPESIFICATION **SECTION 122413** FOR DETAILED INFORMATION ON WINDOW ROLLER SHADES.
9. SEE SHEET A1.10 FOR SIGNAGE DETAILS. PROVIDE BACK PANELS AT ALL SIGNAGE MOUNTED ON GLASS.
10. TRIM WALL PROTECTION AROUND POWER/DATA OUTLETS (TYP.)
11. SEE SHEET A1.9 FOR VISUAL DISPLAY SCHEDULE.
12. REFER TO TECHNOLOGY DRAWINGS BY OTHERS TO COORDINATE VDB's. INFORM ARCHITECT OF CONFLICTS.

EQUIPMENT PLAN LEGEND

X-X = INDICATES CASEWORK. REFER TO SPESIFICATION SECTION 123216 FOR SCHEDULE AND PLASTIC LAMINATE SELECTIONS. ALL CABINETS SHALL SLOPED TOPS AND ALL DOORS SHALL HAVE LOCKS U.N.O.

B-_# = BASE CABINET
W-_# = WALL CABINET
T-_# = TALL CABINET
FILLER = PROVIDE FACE, TOP, BOTTOM AND / OR COUNTERTOP FILLER AS REQUIRED BY TYPE OF CABINET

RS-# = ROLLER SHADE, SPECIFICATION SECTION 122413

= SIGNS (FOR TYPES AND MOUNTING, SEE SHEET A1.25 AND SPEC SECTION 101419, 101423 & 101424

VDB-_# = VISUAL DISPLAY BOARD, SPECIFICATION SECTION 101100

APPLIANCE PLAN LEGEND

SEE SPEC. SECTION 113013

RF-# = REFRIGERATOR
URF-# = UNDERCOUNTER REFRIGERATOR
WSHR = WASHER
MC-# = MICROWAVE
DRY = ELEC. DRYER

EQUIPMENT PLAN NEYNOTES

1. CASEWORK FILLER TYP
2. GYM WALL PADS, 2' W X 6' H X 2" THICK, MOUNTED AT 4' AFF, REFER TO SPECIFICATION SECTION 116623
3. GYM SCOREBOARD, REFER TO SPECIFICATION SECTION 116623
4. FLAT SCREEN TV, SEE TECHNOLOGY DRAWINGS
5. SHORT THROUGH PROJECTOR BY TECHNOLOGY CONSULTANT
6. SIDE RETRACTABLE BASKETBALL BACKSTOP (GLASS) SEE SPECIFICATION SECTION 116623
7. GYMNASIUM DIVIDER, SEE SPEC SECTION 083513
8. VOLLEYBALL SLEEVE, REFER TO SPECIFICATION SECTION 116623
9. FRAME OUT OPENING WITH WOOD TRIM AND PAINT SAME COLOR AS WALL
10. ARCHITECTURAL LETTERS, SEE INTERIOR ELEVATIONS AND SHEET A1.10
11. GLASS IN OPENING WITH FROSTED BOY/GIRL SYMBOL, SEE SHEET A1.10
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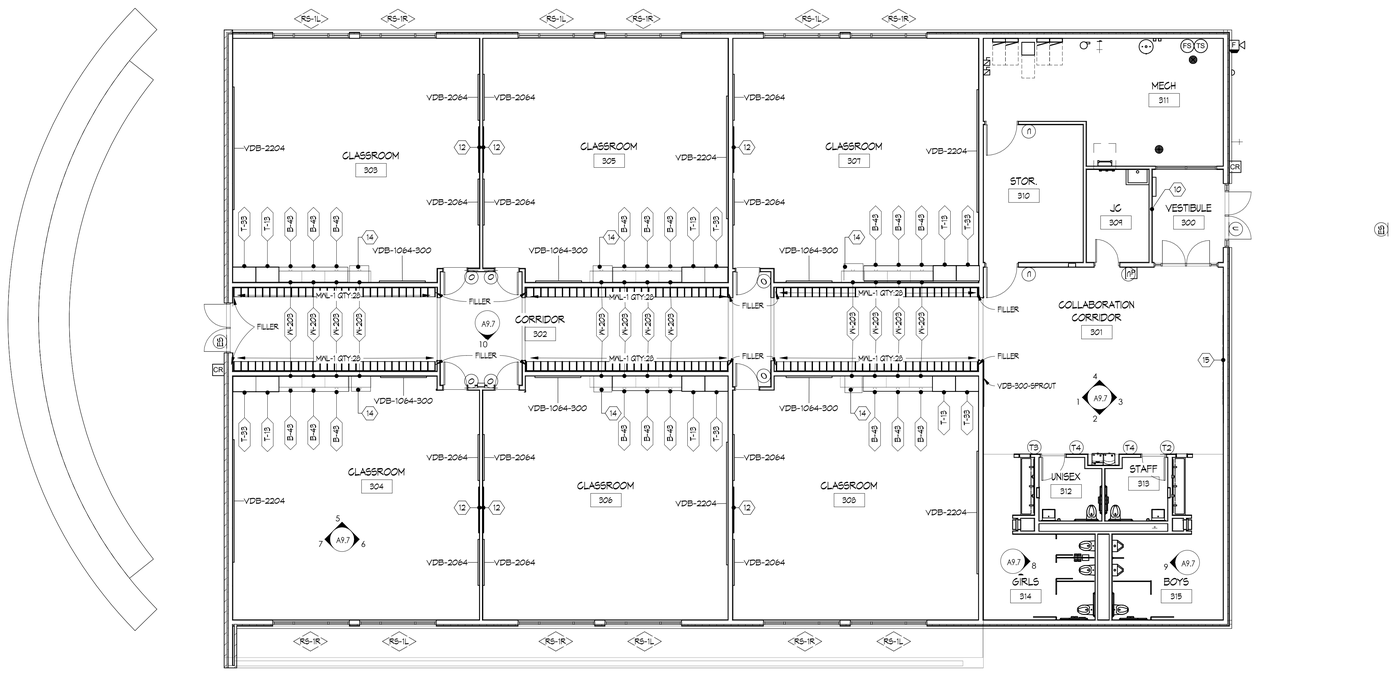
15. ACRYLIC WALL MOUNTED ART DISPLAY
16. FLAT PANEL INFOGRAPHIC
17. PROJECTOR SCREEN, SEE TECHNOLOGY PLAN



1 EQUIPMENT PLAN - UNIT 300
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

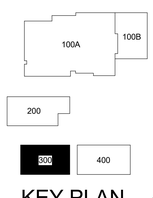
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
EQUIPMENT PLAN - UNIT 300

SHEET NO.
A1.7

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EQUIPMENT PLAN GENERAL NOTES

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

EQUIPMENT PLAN LEGEND

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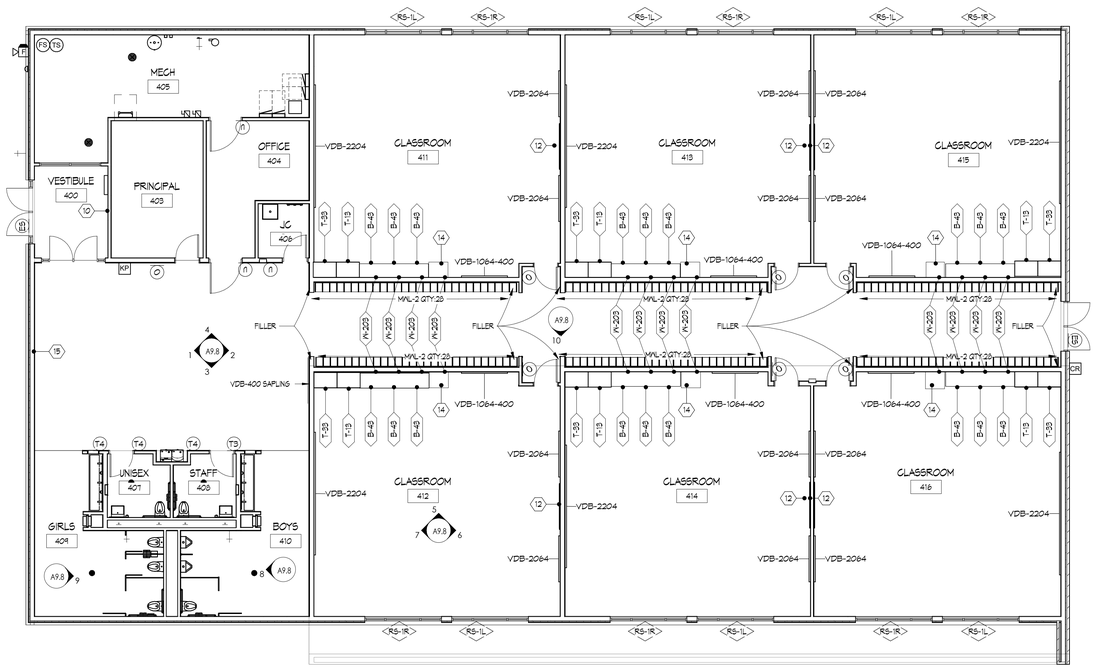
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



EQUIPMENT PLAN NEYNOTES

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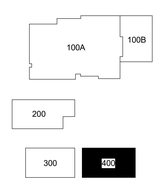
17. PROJECTOR SCREEN, SEE TECHNOLOGY PLAN

1 EQUIPMENT PLAN - UNIT 400
1/8" = 1'-0"

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
EQUIPMENT PLAN - UNIT 400

SHEET NO.
A1.8

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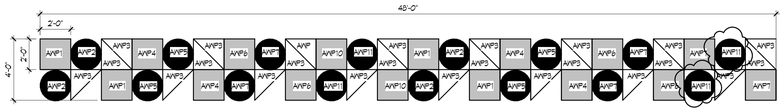
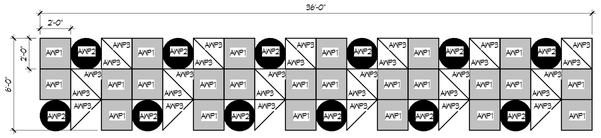
ACOUSTIC WALL PANEL SCHEDULE (AWP-#)

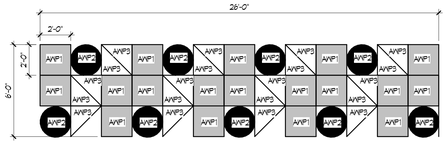
AWP1- DARK BLUE
AWP2- LIGHT BLUE
AWP3- GRAY
AWP4- DARK ORANGE
AWP5- LIGHT ORANGE
AWP6- BRIGHT BLUE
AWP7- LIGHT BRIGHT BLUE
AWP10- DARK PURPLE
AWP11- LIGHT PURPLE



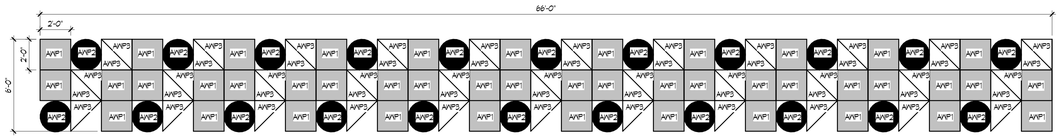
AWP-136



AWP-141 & AWP-145



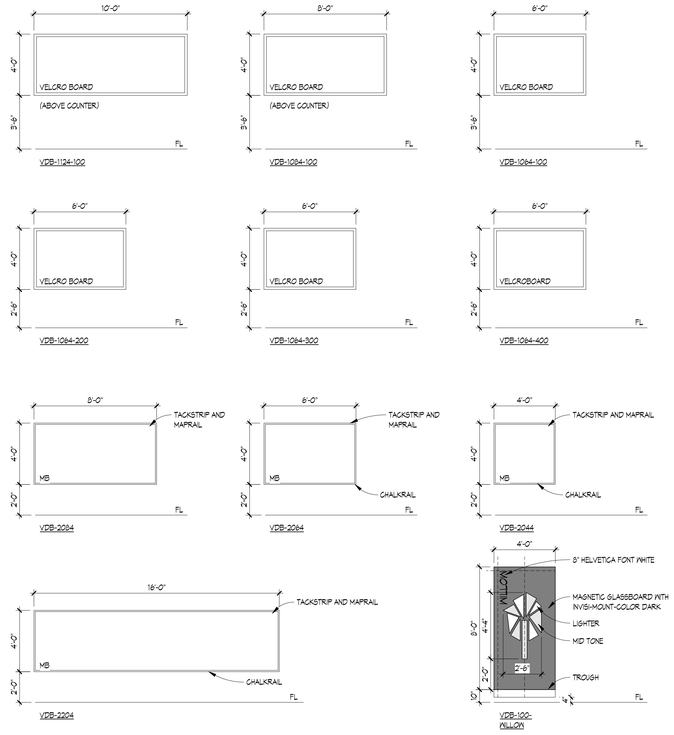
AWP-151



AWP-156

VDB SCHEDULE (VDB-#)

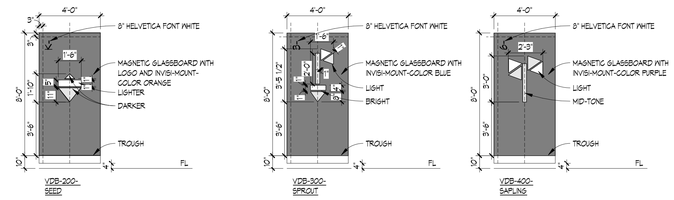
COORDINATE LOCATIONS WITH TECHNOLOGY DEVICES BEFORE INSTALLATION

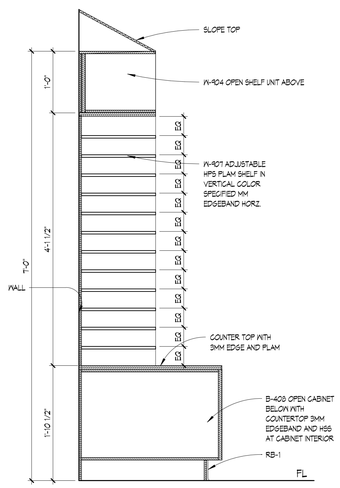


ROLLER SHADES (RS-#)

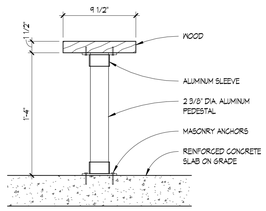
SECTION 122413

RS-1L	SINGLE ROLLER SHADE	3% LIGHT FILTERING	LEFT SIDE MANUALLY OPERATED
RS-1R	SINGLE ROLLER SHADE	3% LIGHT FILTERING	RIGHT SIDE MANUALLY OPERATED
RS-2R	(CAFETERIA) DUAL ROLLER SHADE	3% LIGHT FILTERING/ BLACK OUT	RIGHT SIDE MOTORIZED

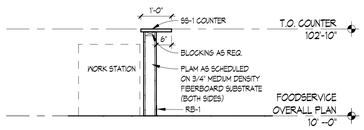




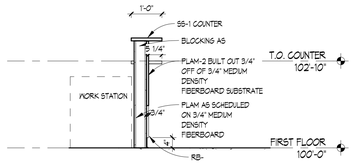
6 MAILBOX CASEWORK DETAIL
1" = 1'-0"



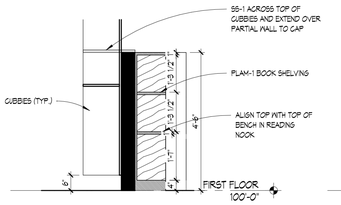
7 LOCKER ROOM BENCH SECTION
1 1/2" = 1'-0"



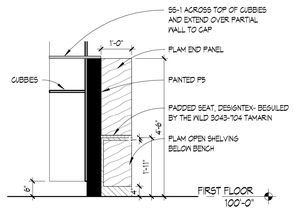
3 RECEPTION DESK ADA COUNTER
1/2" = 1'-0"



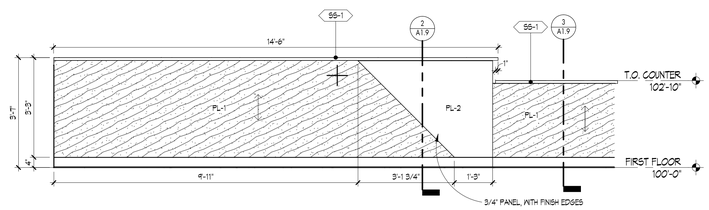
2 RECEPTION DESK TRANSACTION COUNTER
1/2" = 1'-0"



5 READING NOOK SHELVING
1/2" = 1'-0"



4 READING NOOK SECTION
1/2" = 1'-0"



1 FRONT DESK
1/2" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 01	03/01/2024
Addendum 03	03/15/2024

LSD SB-005
JOB 2616.01A

SHEET TITLE
EQUIPMENT SCHEDULES & DETAILS

SHEET NO.
A1.9

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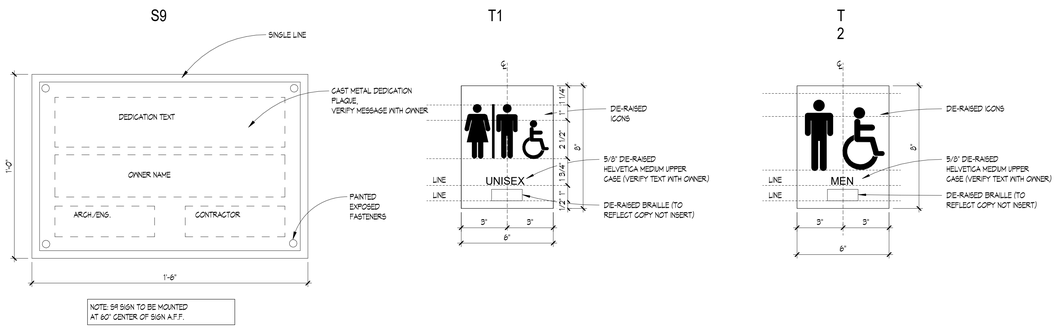
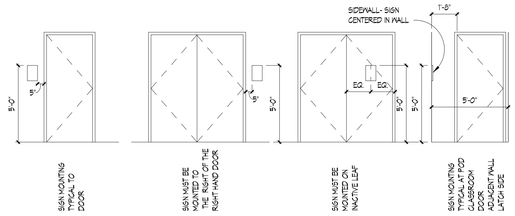
SIGNAGE TYPES



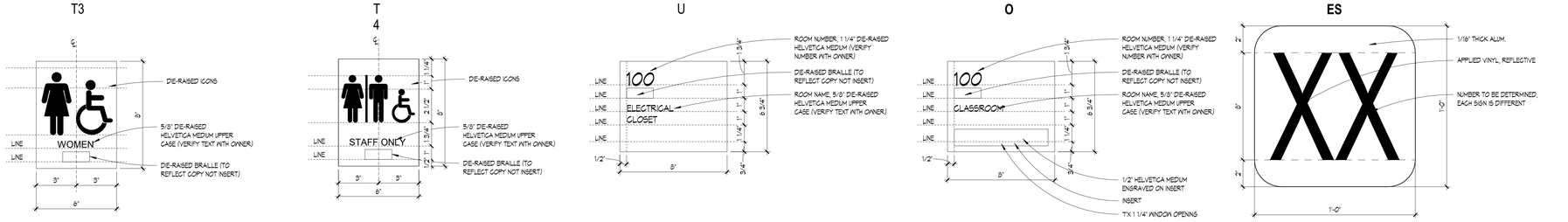
NOTE: S9 SIGN TO BE MOUNTED AT 60" CENTER OF SIGN A.F.F.

SIGNAGE MOUNTING HEIGHTS (U.N.O.)



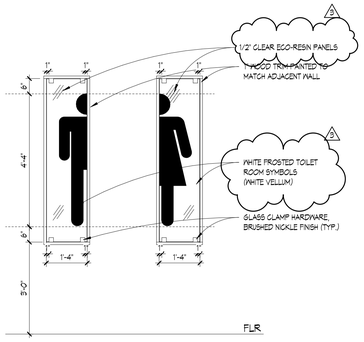
EXTERIOR SIGNAGE SCHEDULE (ES)

DOOR TAG	LOCATION	DOOR NUMBER
100A	VESTIBULE	01
110	CLINIC	02
121B	ELECT.	03
123B	RECEIVING	04
136C	CAFETERIA	05
136D	CAFETERIA	06
136F	CAFETERIA	07
139C	MUSIC	08
101H	VESTIBULE	09
141B	ART	10
145B	CLASSROOM	11
102B	VESTIBULE	12
156D	GYMNASIUM	13
156E	GYMNASIUM	14



NOTE: SIGN TO BE MOUNTED ON INSIDE AND OUTSIDE OF EACH EXTERIOR DOOR WHEN MOUNTING ON GLASS, ELIMINATE ALUMINUM PANELS ADHERE NUMBER DIRECTLY TO GLASS.

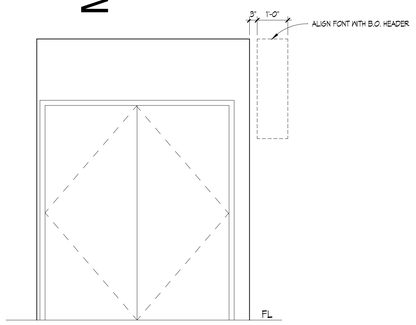
TOILET ROOM GLASS SIGNAGE



ROOM LETTERING

VINYL LETTERING 1'-0" WHITE FONT- HELVETICA MEDIUM UPPER CASE

GYM
MUSIC
ART
SCI.
RES.



*MIRROR AS SHOWN N INTERIOR ELEVATIONS

ARCHITECTURAL LETTERING

3D 5" WHITE FONT- HELVETICA MEDIUM UPPER CASE

UNIT 100-MAIN OFFICE
UNIT-100-CAFETERIA

6'-0"
WILLOW SCHOOL

UNIT 100-ART DISPLAYS
UNIT 200-ART DISPLAY
UNIT 300-ART DISPLAY
UNIT 400-ART DISPLAY

5'-3"
WILLOW STUDENT WORK

2'-6" WHITE VINYL- HELVETICA MEDIUM UPPER CASE

UNIT 200-VESTIBULE
K-2

UNIT 300-VESTIBULE
3-5

UNIT 400-VESTIBULE
6-8

FAMILY ROOM LETTERING

10" WHITE FONT- HELVETICA MEDIUM UPPER CASE

PANTRY
3'-1"

LAUNDRY
5'-7"

RESTROOM
4'-5"

SIGNAGE

3" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

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LSD SB-005
JOB 2616.01A

SHEET TITLE
SIGNAGE

SHEET NO.
A1.10

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TOILET ACCESSORIES

MARK	DESCRIPTION
TA-1	TOILET PAPER DISPENSER - OFCI
TA-2	LIQUID SOAP DISPENSER - OFCI
TA-3A	SEMI-RECESSED PAPER TOWEL DISPENSER/WASTE RECEPTABLE COMBO UNIT - 19 GAL.
TA-3B	RECESSED PAPER TOWEL DISPENSER/WASTE RECEPTABLE COMBO UNIT - 4.9 GAL.
TA-3C	SEMI-RECESSED PAPER TOWEL DISPENSER/WASTE RECEPTABLE COMBO UNIT - 12 GAL.
TA-4	SANITARY NAPKIN DISPOSAL UNIT
TA-5	GRAB BAR - 42"
TA-6	GRAB BAR - 36" (AMBULATORY)
TA-7	VERTICAL GRAB BAR - 18"
TA-8	GRAB BAR - 24" x 36" (SHOWER)
TA-9	MIRROR - 2'-0"w x 3'-0"h
TA-10	SHOWER ROD & CURTAIN
TA-11	MOP & BROOM RACK
TA-12	WARDROBE HOOK
TA-13	BABY CHANGING STATION

NOTES:

1. INSTALL UNDERLAVATORY GUARDS AT EACH LAVATORY PLUMBING CONNECTION PER SPECIFICATION SECTION 102800.
2. SEE EQUIPMENT PLANS FOR ADDITIONAL ACCESSORIES NOT LOCATED IN TOILET ROOMS.
3. TOILET ACCESSORIES NOTED 'PROVIDED BY OWNER' SHALL BE CONTRACTOR INSTALLED.
4. SLOPE FLOOR MIN. 1/8" PER FOOT TO DRAIN, U.N.O.

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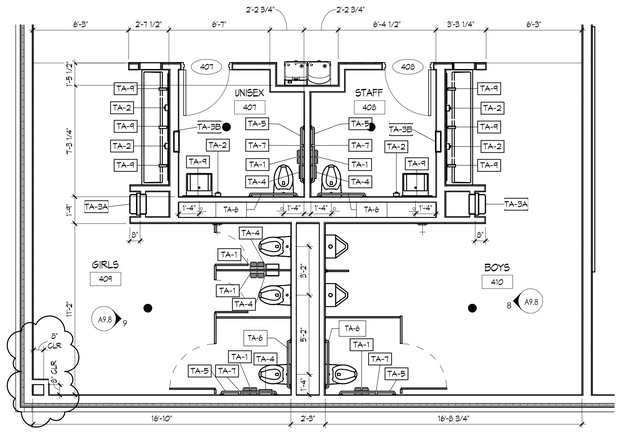
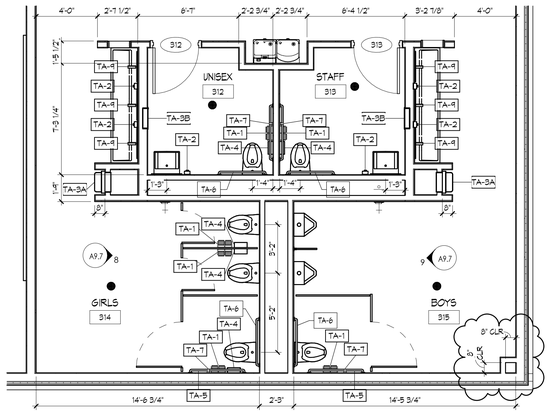
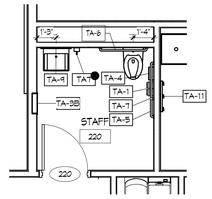


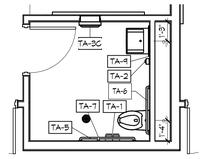
8 UNIT 400 TOILET
1/4" = 1'-0"



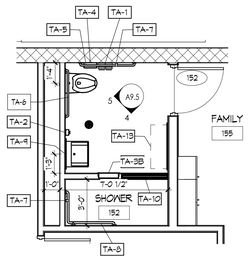
7 UNIT 300 TOILET
1/4" = 1'-0"



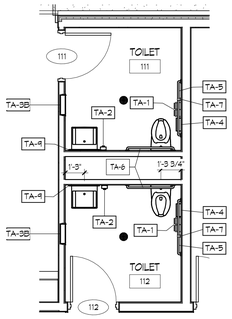
6 UNIT 200 STAFF TOILET
1/4" = 1'-0"



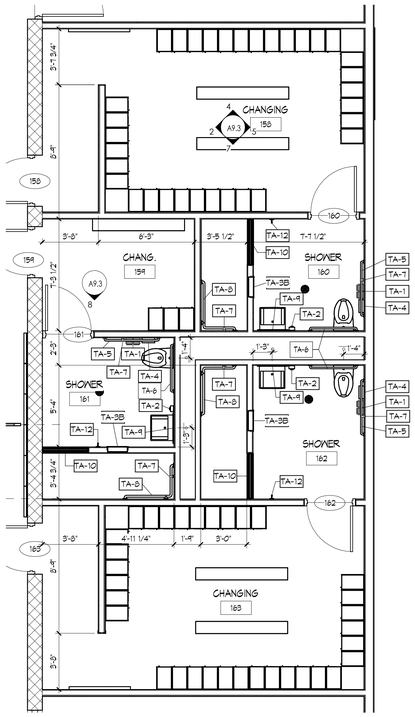
5 UNIT 200 TYP. TOILET
1/4" = 1'-0"



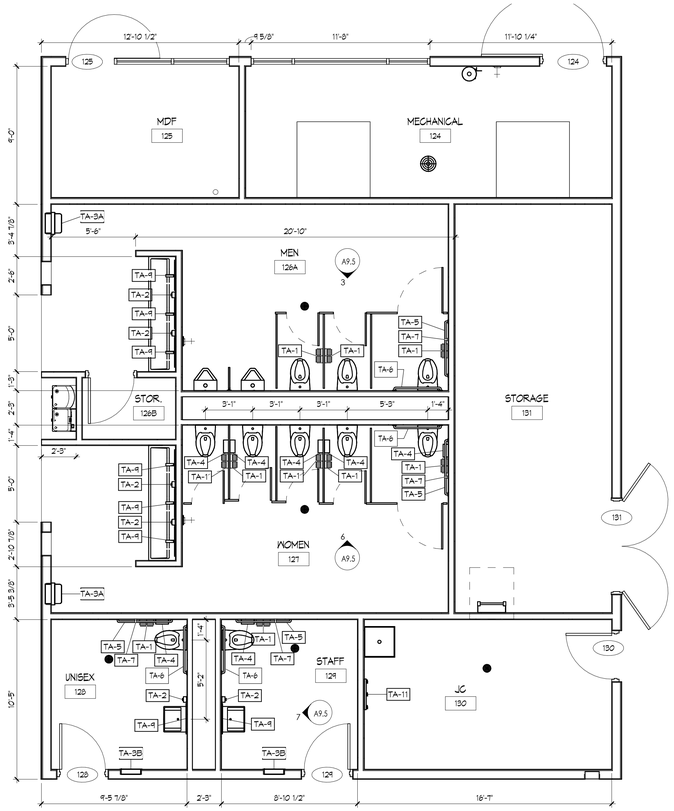
4 UNIT 100 FAMILY ROOM TOILET
1/4" = 1'-0"



3 UNIT 100 OFFICE SUITE TOILET
1/4" = 1'-0"



2 UNIT 100 GYMNASIUM CHANGING RM
1/4" = 1'-0"



1 UNIT 100 TOILET ROOMS
1/4" = 1'-0"

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024

LSD SB-005
JOB 2616.01A

SHEET TITLE
ENLARGED PLANS

SHEET NO.
A1.11

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REFLECTED CEILING LEGEND

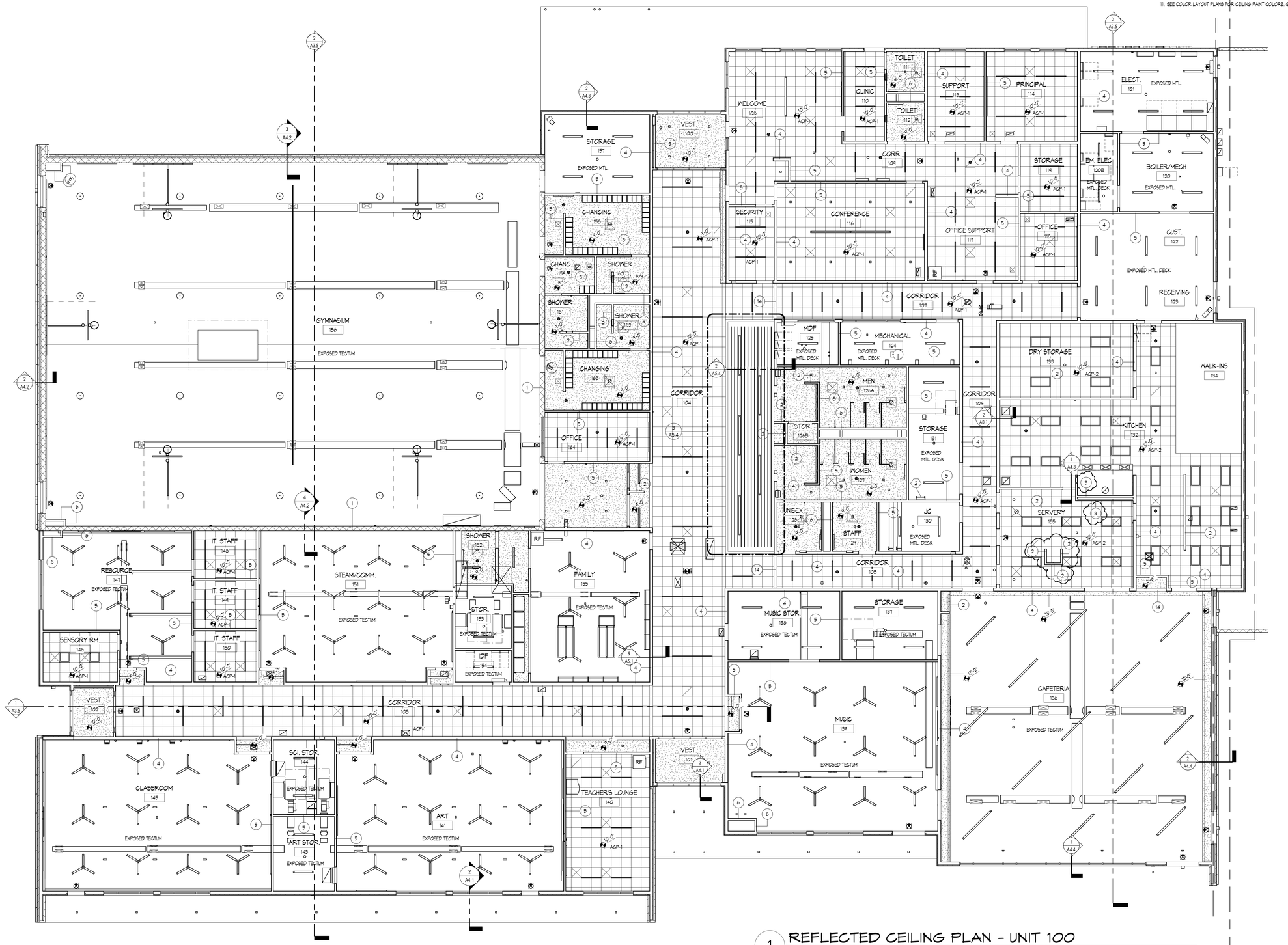
- PARTITION TYPE
- 2x4' SURFACE MOUNTED LIGHT FIXTURE
- 1'x4' SURFACE MOUTNED LIGHT FIXTURE
- 2'x2' SURFACED / PENDANT MOUTNED LIGHT FIXTURE
- 12'x12' SURFACE / PENDANT MOUNTED LIGHT FIXTURE
- SURFACE / PENDANT MOUNTED LIGHT FIXTURE
- 2'x4' RECESSED LIGHT FIXTURE
- 1'x4' RECESSED LIGHT FIXTURE
- 2'x2' RECESSED LIGHT FIXTURE
- 12'x12' RECESSED LIGHT FIXTURE
- RECESSED LIGHT FIXTURE
- CEILING MOUNTED EXIT SIGN
- INDUSTRIAL FLUORESCENT
- COVE LIGHT FIXTURE
- SMOKE DETECTOR
- PUBLIC ADDRESS SPEAKER
- SOUND SYSTEM SPEAKER
- DROP CORD RECEPTACLE
- SPRINKLER HEAD
- SUPPLY DIFFUSER
- SUPPLY DIFFUSER
- RETURN / EXHAUST GRILLE
- SLOT DIFFUSER
- TRACK LIGHT

REFLECTED CEILING PLAN KEYNOTES

1. PAINTED EXPOSED STRUCTURE. REFER TO COLOR LAYOUT SHEETS FOR ADDITIONAL INFO.
2. NEW LADDER AND ROOF ACCESS HATCH. REFER TO DETAIL ON A5.1.
3. ALIGN GYP SOFFIT WITH TOP OF LOCKERS.

REFLECTED CEILING PLAN GENERAL NOTES

1. FOR PARTITION TYPES AND BULKHEAD DETAILS REFER TO SHEET A2.5 .
2. PROVIDE 'BULLNOSE' CMU UP TO FINISH CEILINGS, TYPICAL AT ALL OUTSIDE CORNERS OF WALLS.
3. REFER TO CODE COMPLIANCE PLANS FOR VERTICAL FIRE RESISTANT RATINGS AT WALLS AND HORIZONTAL FIRE RESISTANT RATINGS AT CEILINGS.
4. PROVIDE RATED SEALANT AND/ OR STOPPING AT ALL PENETRATIONS AND OPENING THROUGH ALL NEW CORRIDOR WALLS AND FIRE RATED PARTITIONS.
5. COORDINATE EXACT LOCATION REQUIRED FOR GYP. CEILING 24" x 24" ACCESS PANELS INDICATED WITH OTHER TRADES. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. PROVIDE ACOUSTICAL SEALANT AND/ OR STOPPING AT ALL PENETRATIONS THROUGH NON-FIRE RATED WALLS.
7. REFER TO PAINT SPECIFICATIONS FOR COLOR INFORMATION.
8. REFER TO ACOUSTICAL PANEL CEILING SPECIFICATIONS FOR TILE INFORMATION.
9. FACTORY FINISH ALL EXPOSED GRID ON ALL SURFACE. REFER TO APG SPECIFICATIONS.
10. IF CONTROL JOINTS ARE NOT INDICATED IN GYPSUM BOARD CEILINGS, PROVIDE AS RECOMMENDED.
11. SEE COLOR LAYOUT PLANS FOR CEILING PAINT COLORS. GYP CEILINGS PAINTED P-1, U.N.O.



1 REFLECTED CEILING PLAN - UNIT 100

1/8" = 1'-0"

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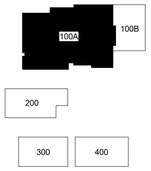
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
REFLECTED CEILING PLAN - UNIT 100A

SHEET NO.
A2.1A

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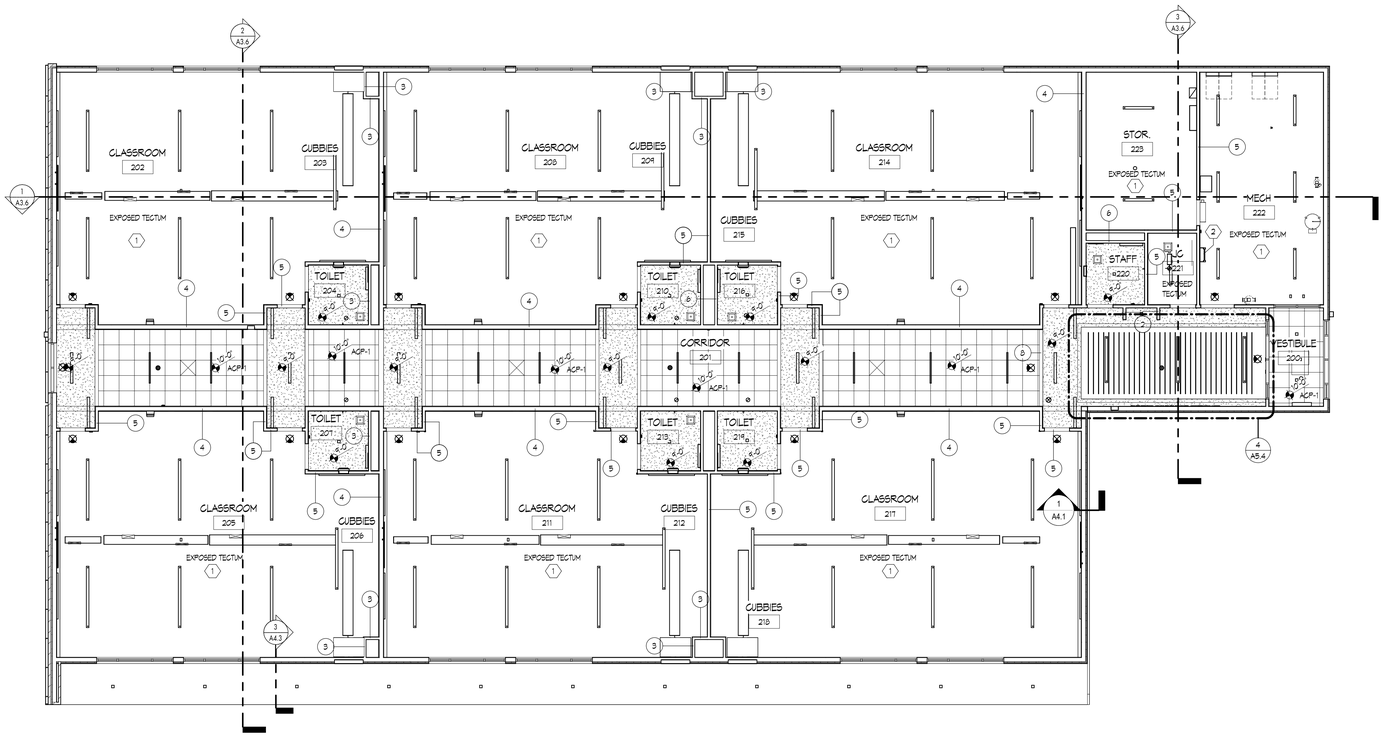
REFLECTED CEILING PLAN GENERAL NOTES

1. FOR PARTITION TYPES AND BULKHEAD DETAILS REFER TO SHEET A2.5 .
2. PROVIDE "BULLNOSE" CMU UP TO FINISH CEILINGS, TYPICAL AT ALL OUTSIDE CORNERS OF WALLS.
3. REFER TO CODE COMPLIANCE PLANS FOR VERTICAL FIRE RESISTANT RATINGS AT WALLS AND HORIZONTAL FIRE RESISTANT RATINGS AT CEILINGS.
4. PROVIDE RATED SEALANT AND/ OR STOPPING AT ALL PENETRATIONS AND OPENING THROUGH ALL NEW CORRIDOR WALLS AND FIRE RATED PARTITIONS.
5. COORDINATE EXACT LOCATION REQUIRED FOR GYP. CEILING 24" x 24" ACCESS PANELS INDICATED WITH OTHER TRADES. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. PROVIDE ACOUSTICAL SEALANT AND/ OR STOPPING AT ALL PENETRATIONS THROUGH NON-FIRE RATED WALLS.
7. △ REFER TO PAINT SPECIFICATIONS FOR COLOR INFORMATION.
8. REFER TO ACOUSTICAL PANEL CEILING SPECIFICATIONS FOR TILE INFORMATION.
9. FACTORY FINISH ALL EXPOSED GRID ON ALL SURFACE. REFER TO APC SPECIFICATIONS.
10. IF CONTROL JOINTS ARE NOT INDICATED IN GYPSUM BOARD CEILINGS, PROVIDE AS RECOMMENDED.
11. SEE COLOR LAYOUT PLANS FOR CEILING PAINT COLORS. GYP CEILINGS PAINTED P-1, U.N.O.

REFLECTED CEILING LEGEND

PARTITION TYPE	COVE LIGHT FIXTURE
2x4' SURFACE MOUNTED LIGHT FIXTURE	SMOKE DETECTOR
1x4' SURFACE MOUTNED LIGHT FIXTURE	PUBLIC ADDRESS SPEAKER
2x2' SURFACED / PENDANT MOUTNED LIGHT FIXTURE	SOUND SYSTEM SPEAKER
12"x12" SURFACE / PENDANT MOUNTED LIGHT FIXTURE	DROP CORD RECEPTACLE
SURFACE / PENDANT MOUNTED LIGHT FIXTURE	SPRINKLER HEAD
2x4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
1x4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
2x2 RECESSED LIGHT FIXTURE	RETURN / EXHAUST GRILLE
12"x12" RECESSED LIGHT FIXTURE	SLOT DIFFUSER
RECESSED LIGHT FIXTURE	TRACK LIGHT
CEILING MOUNTED EXIT SIGN	
INDUSTRIAL FLUORESCENT	



1 REFLECTED CEILING PLAN - UNIT 200
1/8" = 1'-0"

REFLECTED CEILING PLAN KEYNOTES

1. PAINTED EXPOSED STRUCTURE. REFER TO COLOR LAYOUT SHEETS FOR ADDITIONAL INFO.
2. NEW LADDER AND ROOF ACCESS HATCH. REFER TO DETAIL ON A5.1.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
REFLECTED CEILING PLAN - UNIT 200

SHEET NO.
A2.2

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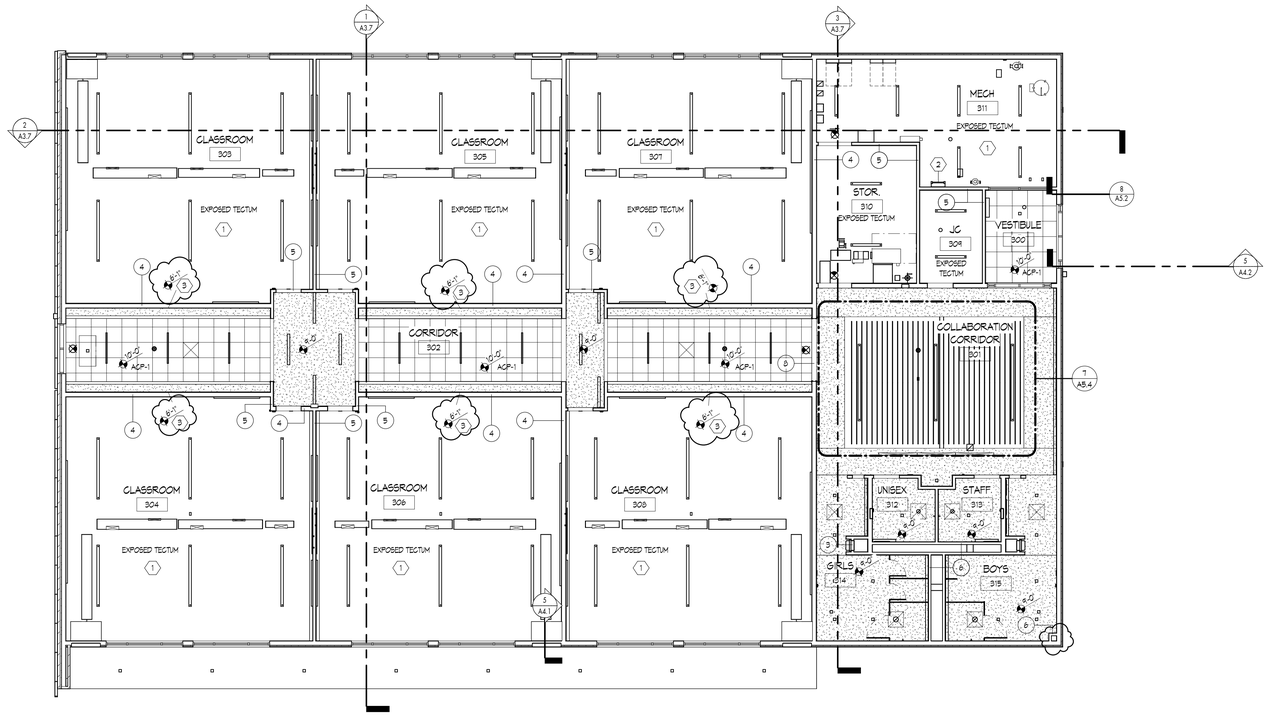
REFLECTED CEILING PLAN GENERAL NOTES

1. FOR PARTITION TYPES AND BULKHEAD DETAILS REFER TO SHEET A2.5 .
2. PROVIDE 'BULLNOSE' GMU UP TO FINISH CEILINGS, TYPICAL AT ALL OUTSIDE CORNERS OF WALLS.
3. REFER TO CODE COMPLIANCE PLANS FOR VERTICAL FIRE RESISTANT RATINGS AT WALLS AND HORIZONTAL FIRE RESISTANT RATINGS AT CEILINGS.
4. PROVIDE RATED SEALANT AND/ OR STOPPING AT ALL PENETRATIONS AND OPENINS THROUGH ALL NEW CORRIDOR WALLS AND FIRE RATED PARTITIONS.
5. COORDINATE EXACT LOCATION REQUIRED FOR SYP. CEILING 24" x 24" ACCESS PANELS INDICATED WITH OTHER TRADES. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. PROVIDE ACOUSTICAL SEALANT AND/ OR STOPPING AT ALL PENETRATIONS THROUGH NON-FIRE RATED WALLS.
7. △ REFER TO PAINT SPECIFICATIONS FOR COLOR INFORMATION.
8. REFER TO ACOUSTICAL PANEL CEILING SPECIFICATIONS FOR TILE INFORMATION.
9. FACTORY FINISH ALL EXPOSED GRID ON ALL SURFACE. REFER TO APC SPECIFICATIONS.
10. IF CONTROL JOINTS ARE NOT INDICATED IN GYPSUM BOARD CEILINGS, PROVIDE AS RECOMMENDED.
11. SEE COLOR LAYOUT PLANS FOR CEILING PAINT COLORS. GYP CEILINGS PAINTED P-1, U.N.O.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

REFLECTED CEILING LEGEND

PARTITION TYPE	COVE LIGHT FIXTURE
2X4' SURFACE MOUNTED LIGHT FIXTURE	SMOKE DETECTOR
1X4' SURFACE MOUNTED LIGHT FIXTURE	PUBLIC ADDRESS SPEAKER
2X2' SURFACED / PENDANT MOUTNED LIGHT FIXTURE	SOUND SYSTEM SPEAKER
12"X12" SURFACE / PENDANT MOUNTED LIGHT FIXTURE	DROP CORD RECEPTACLE
SURFACE / PENDANT MOUNTED LIGHT FIXTURE	SPRINKLER HEAD
2X4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
1X4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
2X2' RECESSED LIGHT FIXTURE	RETURN / EXHAUST GRILLE
12"X12" RECESSED LIGHT FIXTURE	SLOT DIFFUSER
RECESSED LIGHT FIXTURE	TRACK LIGHT
CEILING MOUNTED EXIT SIGN	
INDUSTRIAL FLUORESCENT	



REFLECTED CEILING PLAN KEYNOTES

1. PAINTED EXPOSED STRUCTURE. REFER TO COLOR LAYOUT SHEETS FOR ADDITIONAL INFO.
2. NEW LADDER AND ROOF ACCESS HATCH. REFER TO DETAIL ON A5.1.
3. ALIGN GYP SOFFIT WITH TOP OF LOCKERS.

1 REFLECTED CEILING PLAN - UNIT 300
1/8" = 1'-0"

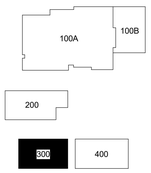
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A
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SHEET TITLE
REFLECTED CEILING PLAN - UNIT 300

SHEET NO.
A2.3

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REFLECTED CEILING PLAN GENERAL NOTES

1. FOR PARTITION TYPES AND BULKHEAD DETAILS REFER TO SHEET A2.5 .
2. PROVIDE "BULLNOSE" CMU UP TO FINISH CEILINGS, TYPICAL AT ALL OUTSIDE CORNERS OF WALLS.
3. REFER TO CODE COMPLIANCE PLANS FOR VERTICAL FIRE RESISTANT RATINGS AT WALLS AND HORIZONTAL FIRE RESISTANT RATINGS AT CEILINGS.
4. PROVIDE RATED SEALANT AND/ OR STOPPING AT ALL PENETRATIONS AND OPENING THROUGH ALL NEW CORRIDOR WALLS AND FIRE RATED PARTITIONS.
5. COORDINATE EXACT LOCATION REQUIRED FOR GYP. CEILING 24" x 24" ACCESS PANELS INDICATED WITH OTHER TRADES. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. PROVIDE ACOUSTICAL SEALANT AND/ OR STOPPING AT ALL PENETRATIONS THROUGH NON-FIRE RATED WALLS.
7. △ REFER TO PAINT SPECIFICATIONS FOR COLOR INFORMATION.
8. REFER TO ACOUSTICAL PANEL CEILING SPECIFICATIONS FOR TILE INFORMATION.
9. FACTORY FINISH ALL EXPOSED GRID ON ALL SURFACE. REFER TO APC SPECIFICATIONS.
10. IF CONTROL JOINTS ARE NOT INDICATED IN GYPSUM BOARD CEILINGS, PROVIDE AS RECOMMENDED.
11. SEE COLOR LAYOUT PLANS FOR CEILING PAINT COLORS. GYP CEILINGS PAINTED P-1, U.N.O.

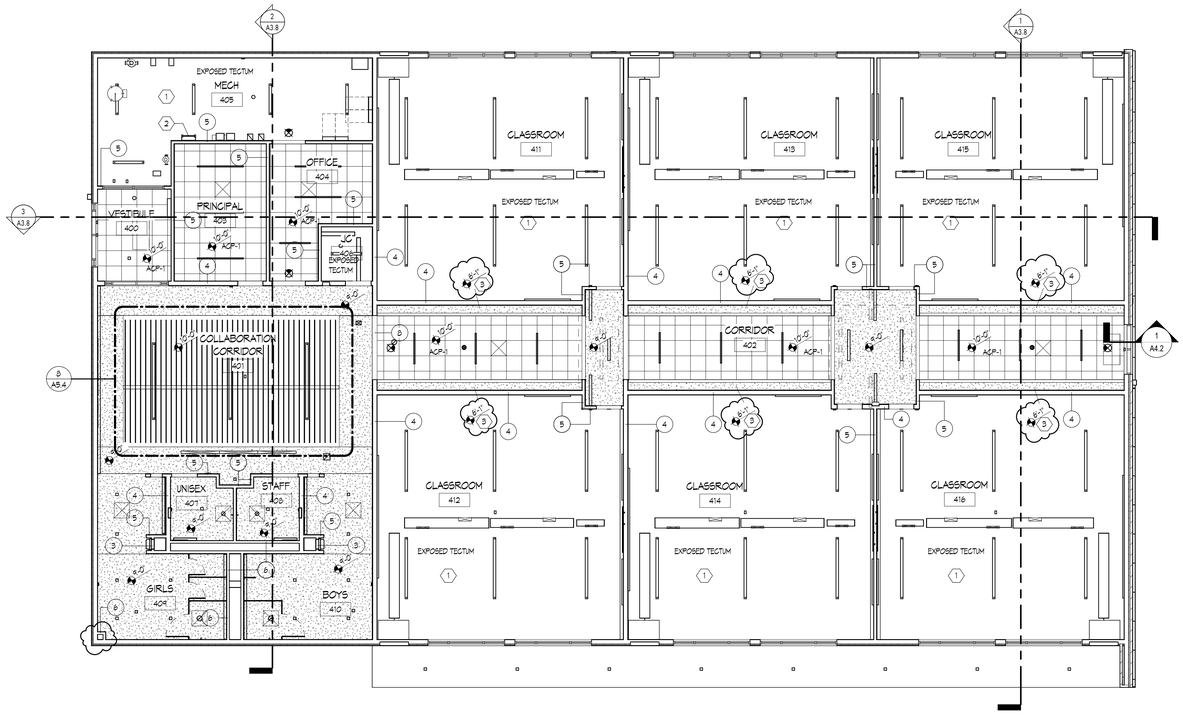
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

REFLECTED CEILING LEGEND

PARTITION TYPE	COVE LIGHT FIXTURE
2x4' SURFACE MOUNTED LIGHT FIXTURE	SMOKE DETECTOR
1x4' SURFACE MOUTNED LIGHT FIXTURE	PUBLIC ADDRESS SPEAKER
2x2' SURFACED / PENDANT MOUTNED LIGHT FIXTURE	SOUND SYSTEM SPEAKER
12"x12" SURFACE / PENDANT MOUNTED LIGHT FIXTURE	DROP CORD RECEPTACLE
SURFACE / PENDANT MOUNTED LIGHT FIXTURE	SPRINKLER HEAD
2x4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
1x4' RECESSED LIGHT FIXTURE	SUPPLY DIFFUSER
2x2' RECESSED LIGHT FIXTURE	RETURN / EXHAUST GRILLE
12"x12" RECESSED LIGHT FIXTURE	SLOT DIFFUSER
RECESSED LIGHT FIXTURE	TRACK LIGHT
CEILING MOUNTED EXIT SIGN	
INDUSTRIAL FLUORESCENT	

REFLECTED CEILING PLAN KEYNOTES

1. PAINTED EXPOSED STRUCTURE. REFER TO COLOR LAYOUT SHEETS FOR ADDITIONAL INFO.
2. NON LADDER ATTIC ACCESS HATCH. REFER TO DETAIL ON A5.1.
3. ALIGN GYP SOFFIT WITH TOP OF LOCKERS.



1 REFLECTED CEILING PLAN - UNIT 400
1/8" = 1'-0"

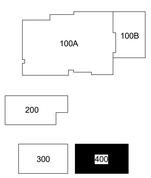
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

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SHEET TITLE
REFLECTED CEILING PLAN - UNIT 400

SHEET NO.
A2.4

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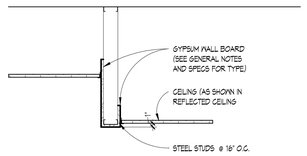
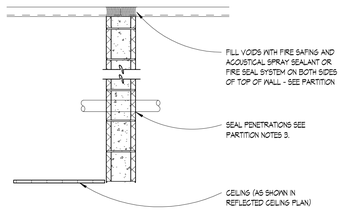


8 BULKHEAD DETAIL
3/4" = 1'-0"

13 NOT USED



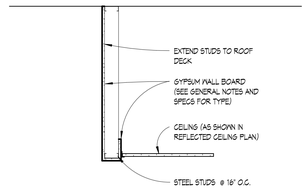
12 BULKHEAD DETAIL
3/4" = 1'-0"

7 NOT USED

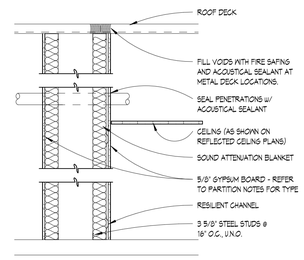
PARTITION NOTES:

PARTITION TAGS ON PLANS AND PARTITION TYPE DETAILS HAVE BEEN PROVIDED TO SHOW GENERAL INTENT OF THE CONSTRUCTION. CONTRACTORS MUST VERIFY EACH CONDITION FOR FIRE RATING, BEARING, STRUCTURAL REQUIREMENTS AND WALL FINISHES. PROVIDE APPROPRIATE CONSTRUCTION AS REQUIRED. SPECIFICALLY INDICATED IN REFERENCED DETAIL OR NOT. REFER TO THE FOLLOWING NOTES FOR ADDITIONAL REQUIREMENTS AND DIRECTIONS FOR APPLICATION OF SEALANT, MATERIALS AND GYPSUM BOARD TYPES.

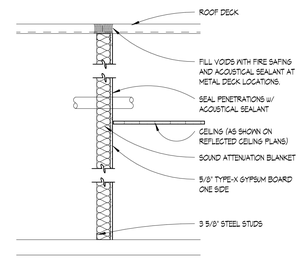
1. REFER TO CODE COMPLIANCE PLANS FOR REQUIRED RATINGS ON WALLS. PROVIDE FIRE RATED SEALANT, FIRESTOPPING AND TYPE 'X' GYPSUM BOARD AS REQUIRED. ALL RECESSES IN FIRE WALLS SHALL HAVE SOLID MASONRY OR MULTIPLE LAYERS OF GYPSUM BOARD AS REQUIRED TO MANTAIN APPLICABLE FIRE RATING. PROVIDE ACOUSTICAL SEALANT AT ALL NON-RATED WALLS. PROVIDE FIRE RATED SEALANT AT ALL RATED WALLS.
2. PROVIDE FIRE RATED SEALANT AND/OR FIRESTOPPING AT ALL PENETRATIONS (CONDUIT, PIPING, DUCTWORK, ETC.) THROUGH FIRE RATED WALLS. REFER TO DETAILS ON THIS PAGE AND COORDINATE WITH MEP TRADES.
3. PROVIDE ACOUSTICAL SEALANT AT ALL PENETRATIONS (CONDUIT, PIPING, DUCTWORK, ETC.) THROUGH NON-FIRE RATED WALLS.
4. PROVIDE ABUSE RESISTANT GYPSUM BOARD FROM FLOOR 8'-0" A.F.F. FOR ALL WALLS NOT COVERED BY TILE OR WALL PROTECTION. PROVIDE TYPE 'X' GYPSUM BOARD FOR THE REMAINDER OF THE WALL AND/OR BULKHEAD. STANDARD TYPE 'X' GYPSUM BOARD MAY BE USED BELOW 4'-0" A.F.F. WHEN BEHIND FIXED ITEMS SUCH AS CASEWORK, SHELVES, LOCKERS, WALL PROTECTION, ETC.
5. PROVIDE COMBINATION WATER AND ABUSE RESISTANT GYPSUM BOARD FROM FLOOR TO 48" A.F.F. FOR ALL WALLS IN JANITOR CLOSETS AND NON-TILED TOILET ROOMS. PROVIDE TYPE 'X' GYPSUM BOARD FOR THE REMAINDER OF THE WALL AND/OR BULKHEAD.
6. REFER TO REFLECTED CEILING PLANS FOR CEILING HEIGHTS, LOCATIONS AND MATERIALS.
7. REFER TO STRUCTURAL DRAWINGS AND WALL SECTIONS FOR FLOOR AND METAL DECK ELEVATIONS AND LOCATIONS.
8. REFER TO COLOR LAYOUT PLANS FOR WALL FINISH.
9. REFER TO BUILDING DETAILS, EQUIPMENT PLANS AND SPECIFICATIONS. PROVIDE BLOCKING IN ALL STEEL STUD PARTITIONS AS REQUIRED FOR CASEWORK SUPPORT, FLATSCREEN TV'S, PROJECTORS, CLASSROOM DISPLAYS, AND OTHER EQUIPMENT. PROVIDE SOLID WOOD BLOCKING FOR ALL DOOR STOP LOCATIONS.
10. REFER TO STRUCTURAL DRAWINGS FOR TOP OF WALL DEFLECTION DETAILS AT MASONRY AND STUD WALLS. PROVIDE SLIP TYPE DEFLECTION TRACK AND DETAILING AT HEAD OF NON-FIRE RATED, NON-BEARING STUD WALLS AS REQUIRED FOR FIRE RATINGS. CONSULT STUD AND GYPSUM BOARD MANUFACTURER STANDARD DETAILING FOR THESE CONDITIONS.
11. PROVIDE MINIMUM 20 GA. STUDS AT 16" O.C. FOR ALL WALLS, U.N.O. STUD SIZE AND GUAGE WILL VERY DEPENDING ON STUD WALL HEIGHT AND AS REQUIRED FOR MINIMUM GUAGE AND SIZE NOTES.
12. PARTITION TYPES ARE A REPRESENTATION OF PARTITION REQUIREMENTS, REFER TO WALL SECTIONS AND BUILDING DETAILS FOR SPECIFIC BLOCK COURSING PATTERN.
13. PROVIDE CONTROL JOINTS IN GYPSUM CEILINGS @ MINIMUM OF 20'-0" O.C. VERTICALLY & HORIZONTALLY.



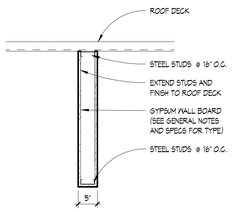
11 BULKHEAD DETAIL
3/4" = 1'-0"



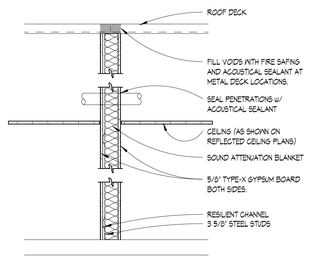
6 METAL STUD CHASE WALL
3/4" = 1'-0"
PROVIDE STUDS @ 24" & 84" AFF HORIZONTALLY FOR VDB & CASEWORK



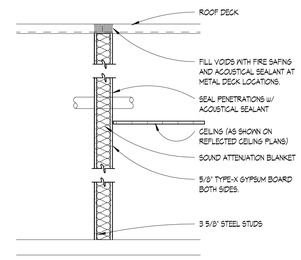
3 METAL STUD PARTITION WALL
3/4" = 1'-0"
PROVIDE STUDS @ 24" & 84" AFF HORIZONTALLY FOR VDB & CASEWORK



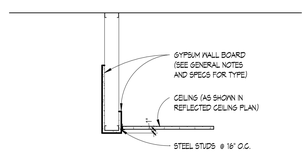
10 BULKHEAD DETAIL
3/4" = 1'-0"



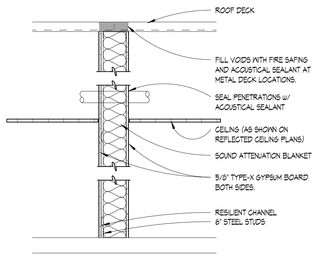
5 METAL STUD PARTITION WALL
3/4" = 1'-0"
PROVIDE STUDS @ 24" & 84" AFF HORIZONTALLY FOR VDB & CASEWORK



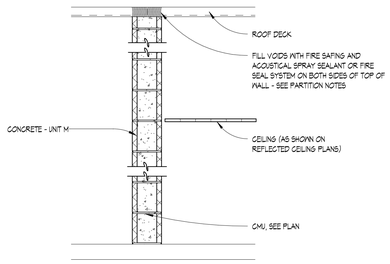
2 METAL STUD PARTITION WALL
3/4" = 1'-0"
PROVIDE STUDS @ 24" & 84" AFF HORIZONTALLY FOR VDB & CASEWORK



9 BULKHEAD DETAIL
3/4" = 1'-0"



4 METAL STUD PARTITION WALL
3/4" = 1'-0"
PROVIDE STUDS @ 24" & 84" AFF HORIZONTALLY FOR VDB & CASEWORK



1 CMU WALL
3/4" = 1'-0"

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Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
INTERIOR PARTITION TYPES

SHEET NO.
A2.5

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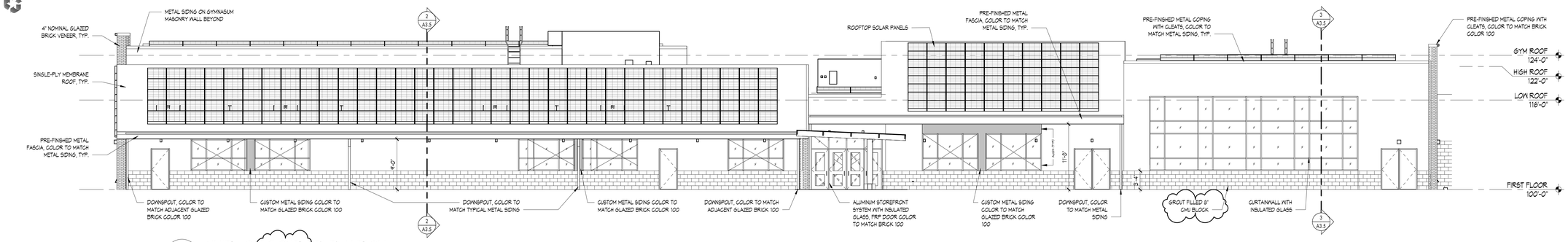
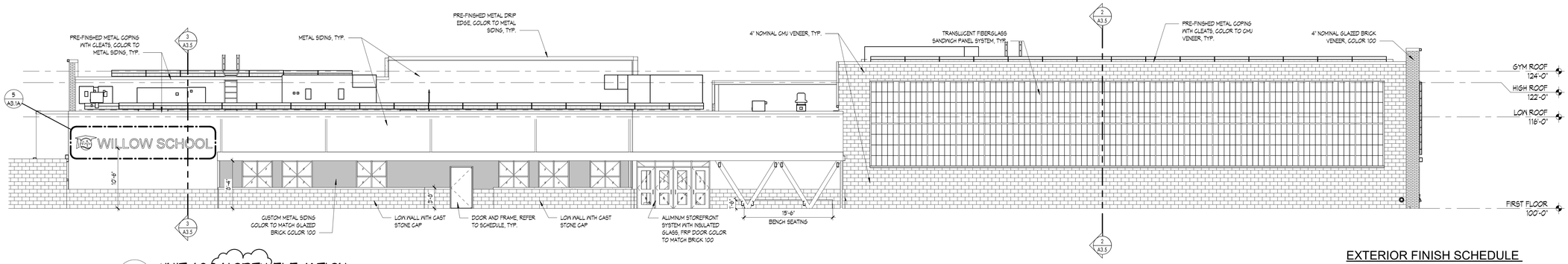
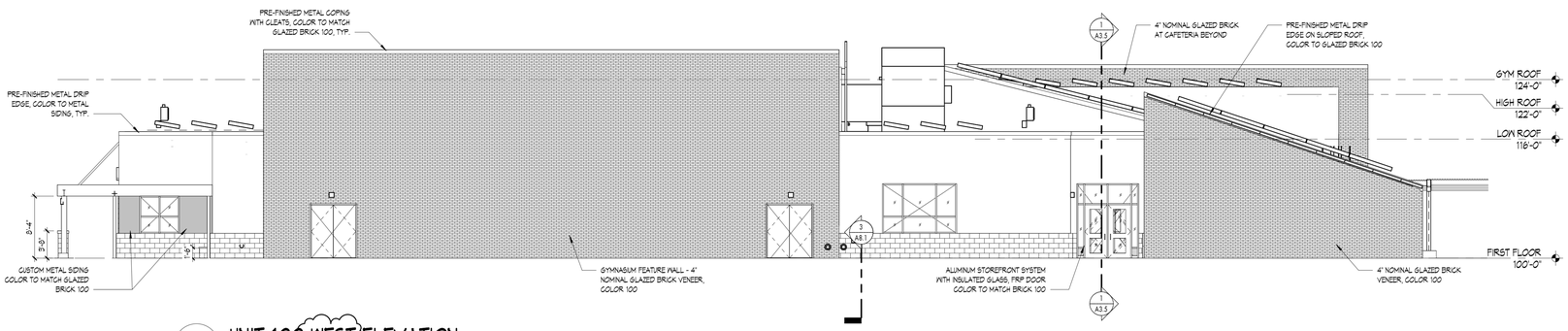


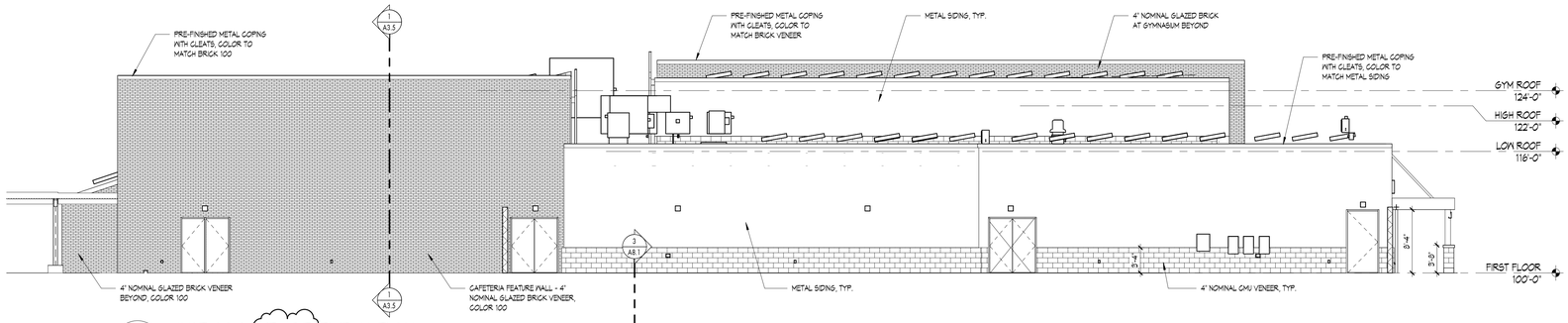
1 UNIT 100 SOUTH ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.1A



2 UNIT 100 NORTH ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.1A



3 UNIT 100 WEST ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.1A



4 UNIT 100A EAST ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.1A

EXTERIOR FINISH SCHEDULE (BASIS-OF-DESIGN)

BRICK 100: BELDEN BRICK
COLOR: STARRY NIGHT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 200: BELDEN BRICK
COLOR: PUMPKIN PATCH GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 300: BELDEN BRICK
COLOR: KEY WEST GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 400: BELDEN BRICK
COLOR: EGGPLANT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

METAL SIDING: CENTRIA ECONOLAP 3/4"
COLOR: VARIES

STANDARD CMU VENEER:
COLOR: GRAY
BLOCK MOTOR: SPEC MIX 'SM100 - GRAY'
BLOCK SEALANT: PHYLON 1422 ACRYLIC - 2 COAT

TRANSLUCENT FIBERGLASS SANDWICH PANEL SYSTEM: KALWALL CORP.
COLOR: WHITE ON INTERIOR, CRYSTAL ON EXTERIOR
ALUMINUM FRAMING COLOR: GRAY
GRID PATTERN: NOMINAL 12" X 24" SHOJI

CURTAINWALL FRAMING: TUBELIGHT 400TU, 2-1/2" X 6"
COLOR: SLATE GRAY
CURTAINWALL SEALANT: TBD

STOREFRONT FRAMING (TYPICAL): TUBELIGHT TU24000, 2" X 4-1/2"
COLOR: SLATE GRAY

INSULATED GLAZING: 1" INSULATED GLASS UNIT WITH LOW-E COATING-GUARDIAN GRAY GLASS SNX62/27 WITH LOW-E ON #2, CLEAR INTERIOR LITE

EXPOSED GALVANIZED LINTELS: COLOR: MATCH ADJACENT COLOR

EXTERIOR FINISH LEGEND

- METAL SIDING (CUSTOM COLOR)
- 4" NOMINAL CMU VENEER
- 4" NOMINAL BRICK VENEER
- TRANSLUCENT FIBERGLASS SANDWICH PANEL

5 BUILDING SIGN
1/4" = 1'-0"
REFER TO 2 / A3.1A

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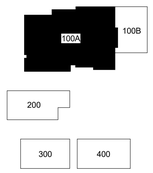
Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A
N

SHEET TITLE
EXTERIOR ELEVATIONS - UNIT 100A

SHEET NO.
A3.1A

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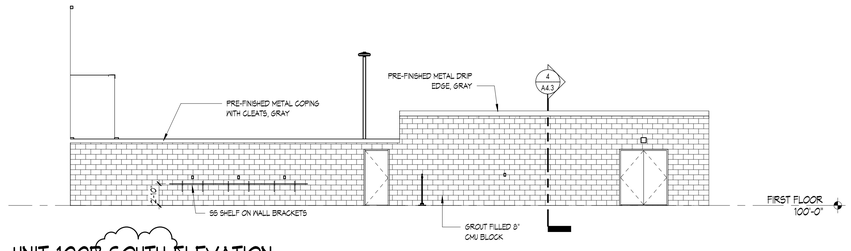
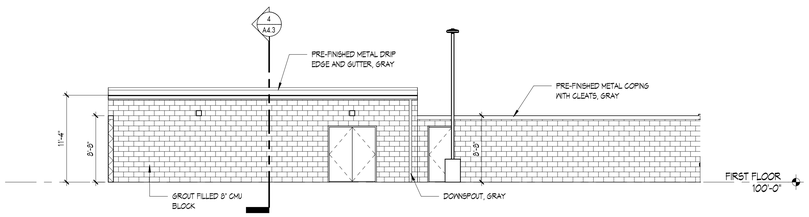


1 UNIT 100B SOUTH ELEVATION

1/8" = 1'-0"

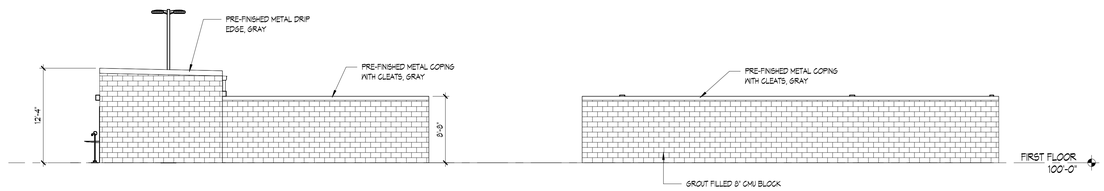
REFER TO 1 / A1.1B



2 UNIT 100B NORTH ELEVATION

1/8" = 1'-0"

REFER TO 1 / A1.1B



3 UNIT 100B EAST ELEVATION

1/8" = 1'-0"

REFER TO 1 / A1.1B

EXTERIOR FINISH SCHEDULE (BASIS-OF-DESIGN)

BRICK 100: BELDEN BRICK
COLOR: STARRY NIGHT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 200: BELDEN BRICK
COLOR: PUMPKIN PATCH GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 300: BELDEN BRICK
COLOR: KEY WEST GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 400: BELDEN BRICK
COLOR: EGGPLANT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

METAL SIDING: CENTRIA ECONOLAP 3/4"
COLOR: VARIES

STANDARD CMU VENEER:
COLOR: GRAY
BLOCK MOTOR: SPEC MIX 'SM100 - GRAY"
BLOCK SEALANT: PHYLON 1422 ACRYLIC - 2 COAT

TRANSLUCENT FIBERGLASS SANDWICH PANEL SYSTEM: KALWALL CORP.
COLOR: WHITE ON INTERIOR, CRYSTAL ON EXTERIOR
ALUMINUM FRAMING COLOR: GRAY
GRID PATTERN: NOMINAL 12" X 24" SHOJI

CURTAINWALL FRAMING: TUBELIGHT 400TU, 2-1/2" X 6"
COLOR: SLATE GRAY
CURTAINWALL SEALANT: TBD

STOREFRONT FRAMING (TYPICAL): TUBELIGHT TU24000, 2" X 4-1/2"
COLOR: SLATE GRAY

INSULATED GLAZING: 1" INSULATED GLASS UNIT WITH LOW-E COATING-
GUARDIAN GRAY GLASS SNX62/27 WITH LOW-E ON #2, CLEAR INTERIOR LITE

EXPOSED GALVANIZED LINTELS: COLOR: MATCH ADJACENT COLOR

EXTERIOR FINISH LEGEND

- METAL SIDING (CUSTOM COLOR)
- 4" NOMINAL CMU VENEER
- 4" NOMINAL BRICK VENEER
- TRANSLUCENT FIBERGLASS SANDWICH PANEL

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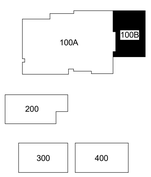
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

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SHEET TITLE
EXTERIOR ELEVATIONS - UNIT 100B

SHEET NO.
A3.1B

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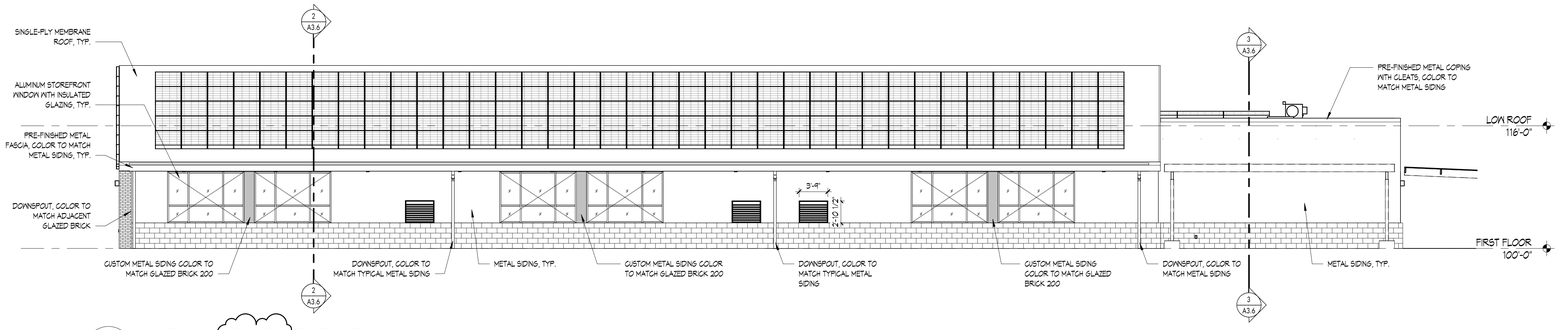
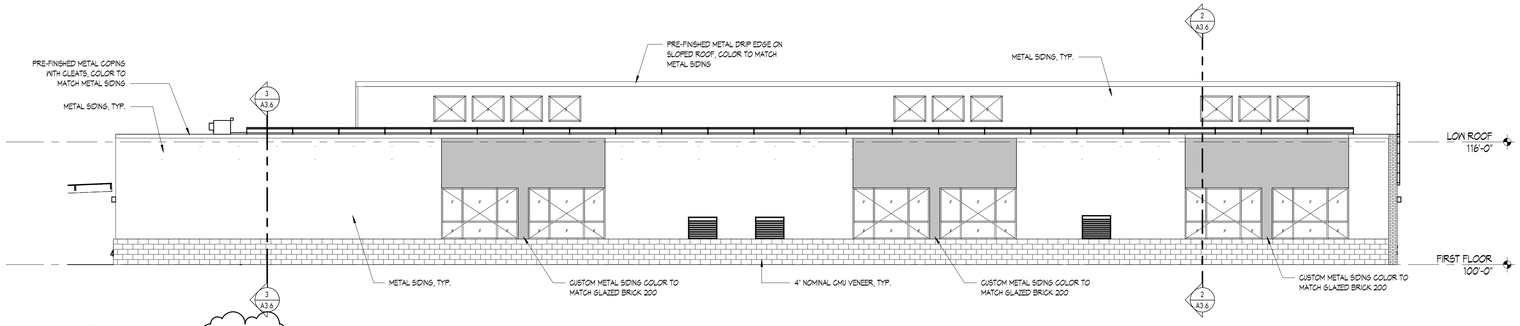


3 UNIT 200 SOUTH ELEVATION

1/8" = 1'-0"

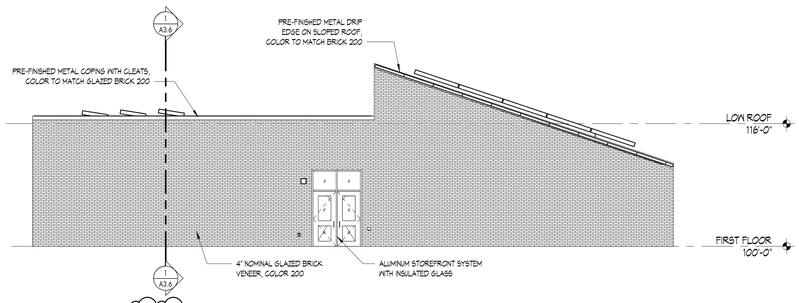
REFER TO 1 / A1.2



4 UNIT 200 NORTH ELEVATION

1/8" = 1'-0"

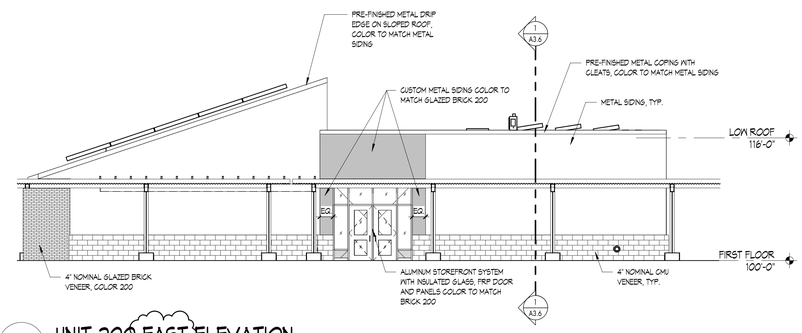
REFER TO 1 / A1.2



2 UNIT 200 WEST ELEVATION

1/8" = 1'-0"

REFER TO 1 / A1.2



1 UNIT 200 EAST ELEVATION

1/8" = 1'-0"

REFER TO 1 / A1.2

EXTERIOR FINISH SCHEDULE (BASIS-OF-DESIGN)

BRICK 100: BELDEN BRICK
COLOR: STARRY NIGHT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 200: BELDEN BRICK
COLOR: PUMPKIN PATCH GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 300: BELDEN BRICK
COLOR: KEY WEST GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 400: BELDEN BRICK
COLOR: EGGPLANT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

METAL SIDING: CENTRIA ECONOLAP 3/4"
COLOR: VARIES

STANDARD CMU VENEER:
COLOR: GRAY
BLOCK MOTOR: SPEC MIX 'SM100 - GRAY"
BLOCK SEALANT: PHYLON 1422 ACRYLIC - 2 COAT

TRANSLUCENT FIBERGLASS SANDWICH PANEL SYSTEM: KALWALL CORP.
COLOR: WHITE ON INTERIOR, CRYSTAL ON EXTERIOR
ALUMINUM FRAMING COLOR: GRAY
GRID PATTERN: NOMINAL 12" X 24" SHOJI

CURTAINWALL FRAMING: TUBELIGHT 400TU, 2-1/2" X 6"
COLOR: SLATE GRAY
CURTAINWALL SEALANT: TBD

STOREFRONT FRAMING (TYPICAL): TUBELIGHT TU24000, 2" X 4-1/2"
COLOR: SLATE GRAY

INSULATED GLAZING: 1" INSULATED GLASS UNIT WITH LOW-E COATING-
GUARDIAN GRAY GLASS SNX62/27 WITH LOW-E ON #2, CLEAR INTERIOR LITE

EXPOSED GALVANIZED LINTELS: COLOR: MATCH ADJACENT COLOR

EXTERIOR FINISH LEGEND

- METAL SIDING (CUSTOM COLOR)
- 4" NOMINAL CMU VENEER
- 4" NOMINAL BRICK VENEER
- TRANSLUCENT FIBERGLASS SANDWICH PANEL

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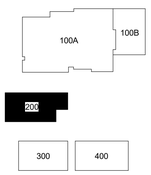

KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
EXTERIOR ELEVATIONS - UNIT 200

SHEET NO.
A3.2

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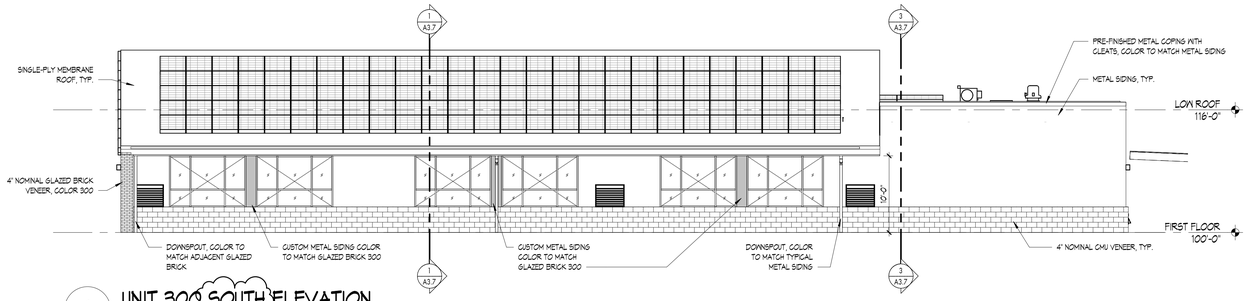
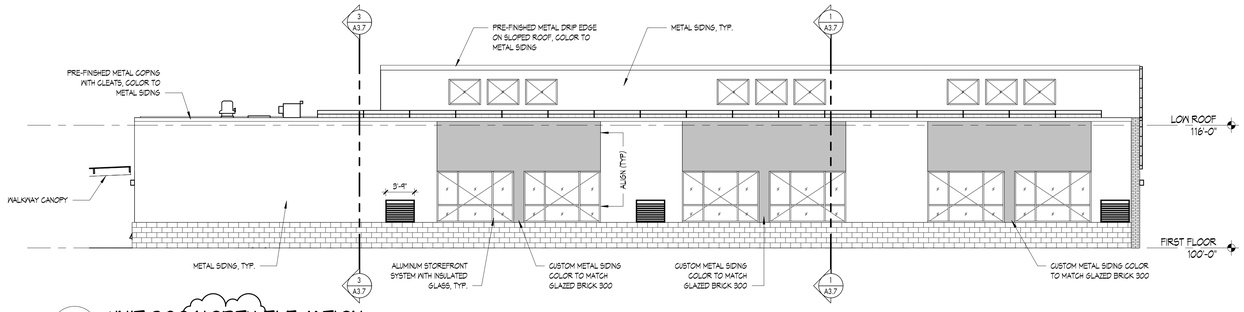


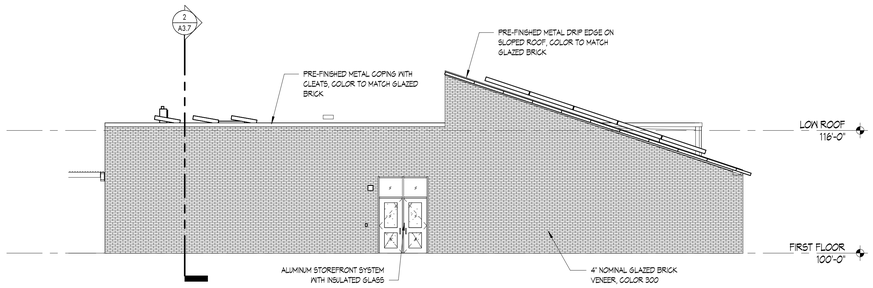
1 UNIT 300 SOUTH ELEVATION

1/8" = 1'-0" REFER TO 1 / A1.3



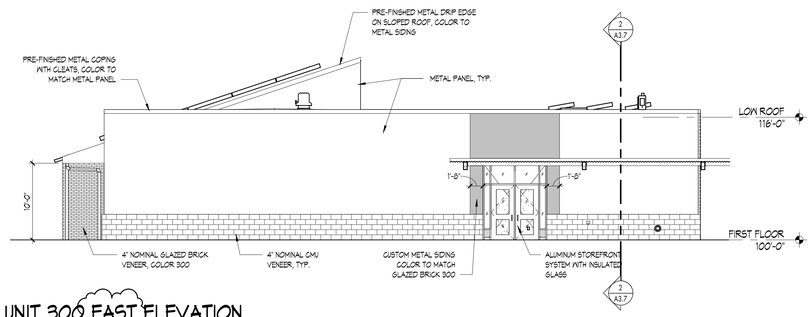
2 UNIT 300 NORTH ELEVATION

1/8" = 1'-0" REFER TO 1 / A1.3



3 UNIT 300 WEST ELEVATION

1/8" = 1'-0" REFER TO 1 / A1.3



4 UNIT 300 EAST ELEVATION

1/8" = 1'-0" REFER TO 1 / A1.3

EXTERIOR FINISH SCHEDULE (BASIS-OF-DESIGN)

BRICK 100: BELDEN BRICK
COLOR: STARRY NIGHT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 200: BELDEN BRICK
COLOR: PUMPKIN PATCH GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 300: BELDEN BRICK
COLOR: KEY WEST GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 400: BELDEN BRICK
COLOR: EGGPLANT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

METAL SIDING: CENTRIA ECONOLAP 3/4"
COLOR: VARIES

STANDARD CMU VENEER:
COLOR: GRAY
BLOCK MOTOR: SPEC MIX SM100 - GRAY"
BLOCK SEALANT: PHYLON 1422 ACRYLIC - 2 COAT

TRANSLUCENT FIBERGLASS SANDWICH PANEL SYSTEM: KALWALL CORP.
COLOR: WHITE ON INTERIOR, CRYSTAL ON EXTERIOR
ALUMINUM FRAMING COLOR: GRAY
GRID PATTERN: NOMINAL 12" X 24" SHOJI

CURTAINWALL FRAMING: TUBELIGHT 400TU, 2-1/2" X 6"
COLOR: SLATE GRAY
CURTAINWALL SEALANT: TBD

STOREFRONT FRAMING (TYPICAL): TUBELIGHT TU24000, 2" X 4-1/2"
COLOR: SLATE GRAY

INSULATED GLAZING: 1" INSULATED GLASS UNIT WITH LOW-E COATING-GUARDIAN GRAY GLASS SNX62/27 WITH LOW-E ON #2, CLEAR INTERIOR LITE

EXPOSED GALVANIZED LINTELS: COLOR: MATCH ADJACENT COLOR

EXTERIOR FINISH LEGEND

- METAL SIDING (CUSTOM COLOR)
- 4" NOMINAL CMU VENEER
- 4" NOMINAL BRICK VENEER
- TRANSLUCENT FIBERGLASS SANDWICH PANEL

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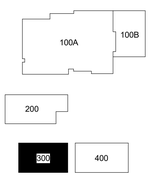
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
EXTERIOR ELEVATIONS - UNIT 300

SHEET NO.
A3.3

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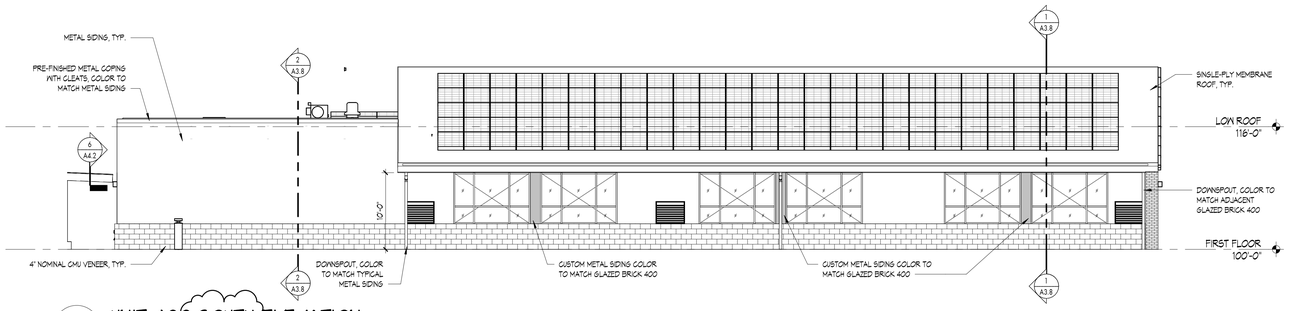
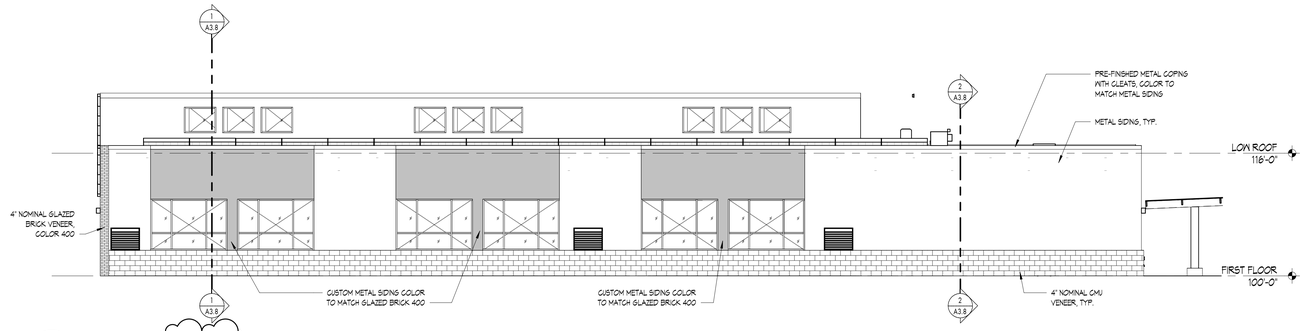
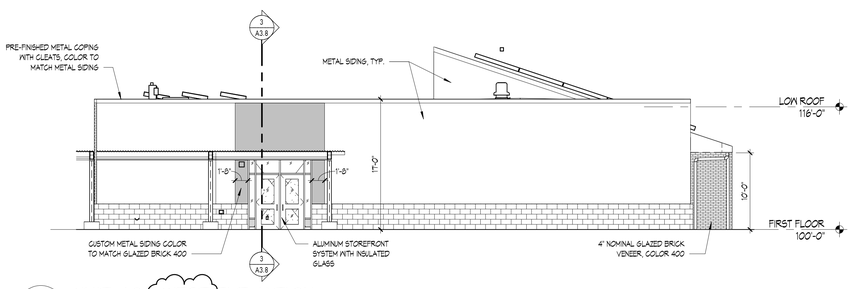


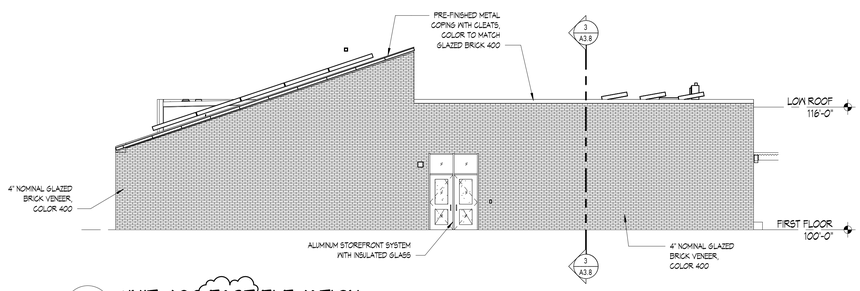
1 UNIT 400 SOUTH ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.3



2 UNIT 400 NORTH ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.3



3 UNIT 400 WEST ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.3



4 UNIT 400 EAST ELEVATION
1/8" = 1'-0"
REFER TO 1 / A1.4

EXTERIOR FINISH SCHEDULE (BASIS-OF-DESIGN)

BRICK 100: BELDEN BRICK
COLOR: STARRY NIGHT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 200: BELDEN BRICK
COLOR: PUMPKIN PATCH GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 300: BELDEN BRICK
COLOR: KEY WEST GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

BRICK 400: BELDEN BRICK
COLOR: EGGPLANT GLAZE
TYPE: FBX
SMOOTH TEXTURE: ASTM-C216
SIZE: 3 5/8"X 2 1/4"X 7 5/8" (MODULAR)

METAL SIDING: CENTRIA ECONOLAP 3/4"
COLOR: VARIES

STANDARD CMU VENEER:
COLOR: GRAY
BLOCK MOTOR: SPEC MIX 'SM100 - GRAY"
BLOCK SEALANT: PHYLON 1422 ACRYLIC - 2 COAT

TRANSLUCENT FIBERGLASS SANDWICH PANEL SYSTEM: KALWALL CORP.
COLOR: WHITE ON INTERIOR, CRYSTAL ON EXTERIOR
ALUMINUM FRAMING COLOR: GRAY
GRID PATTERN: NOMINAL 12" X 24" SHOJI

CURTAINWALL FRAMING: TUBELIGHT 400TU, 2-1/2" X 6"
COLOR: SLATE GRAY
CURTAINWALL SEALANT: TBD

STOREFRONT FRAMING (TYPICAL): TUBELIGHT TU24000, 2" X 4-1/2"
COLOR: SLATE GRAY

INSULATED GLAZING: 1" INSULATED GLASS UNIT WITH LOW-E COATING-
GUARDIAN GRAY GLASS SNX62/27 WITH LOW-E ON #2, CLEAR INTERIOR LITE

EXPOSED GALVANIZED LINTELS: COLOR: MATCH ADJACENT COLOR

EXTERIOR FINISH LEGEND

- METAL SIDING (CUSTOM COLOR)
- 4" NOMINAL CMU VENEER
- 4" NOMINAL BRICK VENEER
- TRANSLUCENT FIBERGLASS SANDWICH PANEL

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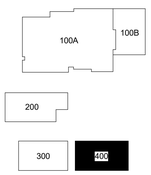
Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A
N

SHEET TITLE
EXTERIOR ELEVATIONS - UNIT 400

SHEET NO.
A3.4

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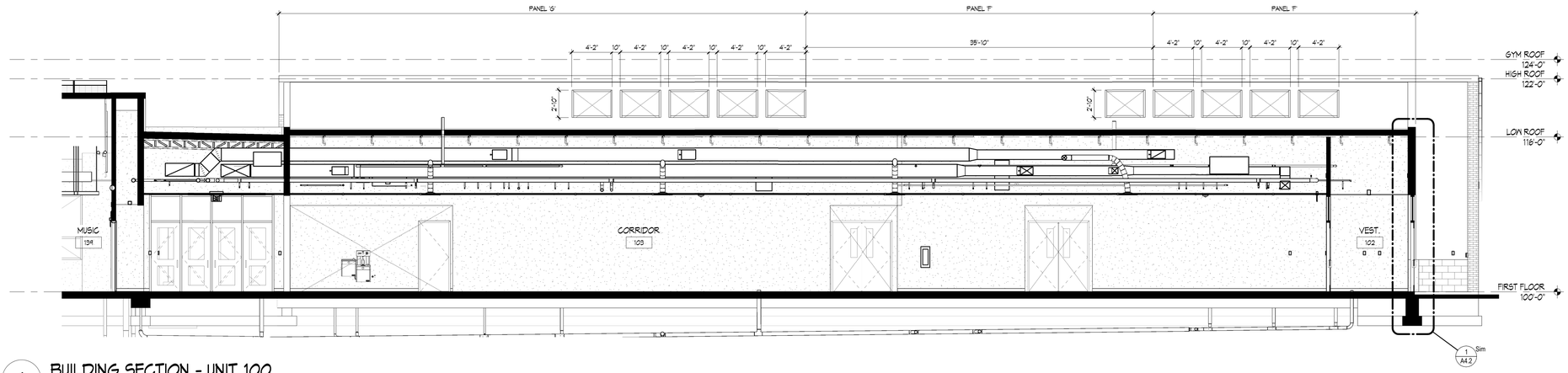
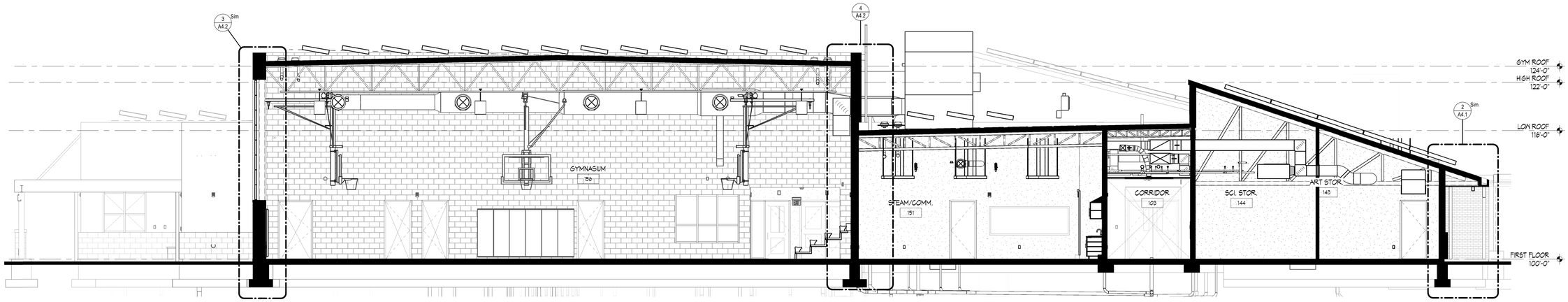


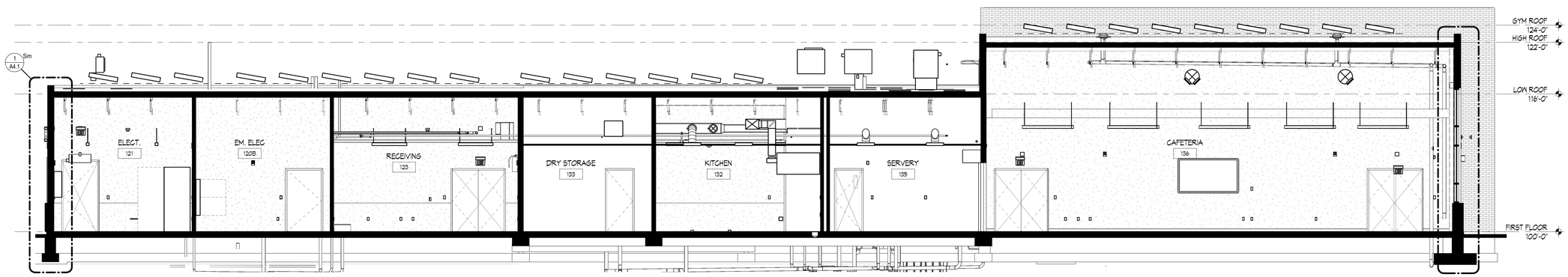
1 BUILDING SECTION - UNIT 100

3/16" = 1'-0" REFER TO 1 / A1.1A



2 BUILDING SECTION - UNIT 100

3/16" = 1'-0" REFER TO 1 / A1.1A



3 BUILDING SECTION - UNIT 100

3/16" = 1'-0" REFER TO 1 / A1.1A

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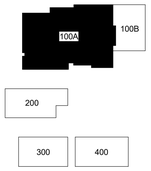
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE

BUILDING SECTIONS - UNIT 100

SHEET NO.

A3.5

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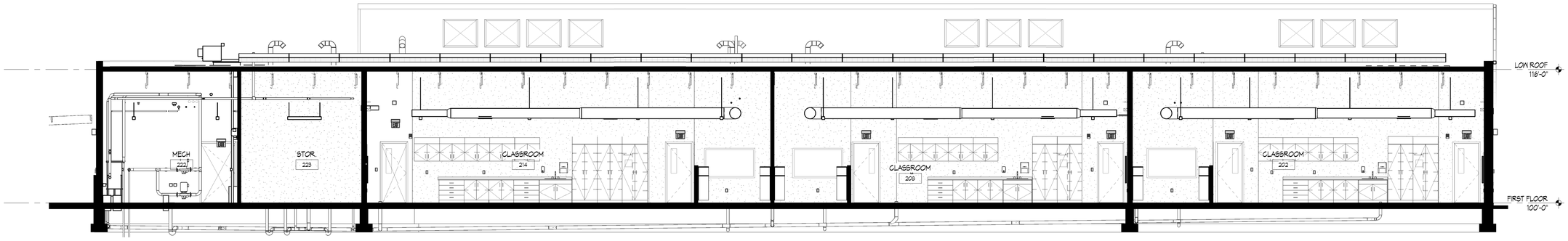
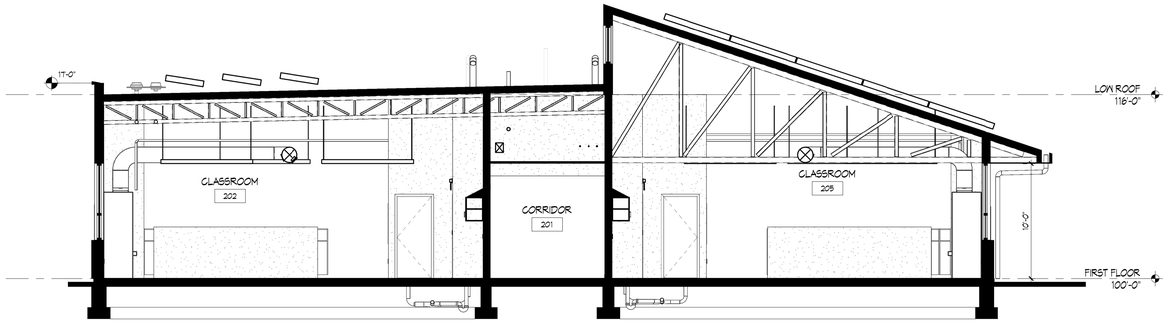


1 BUILDING SECTION - UNIT 200

3/16" = 1'-0" REFER TO 1 / A1.2



2 BUILDING SECTION - UNIT 200

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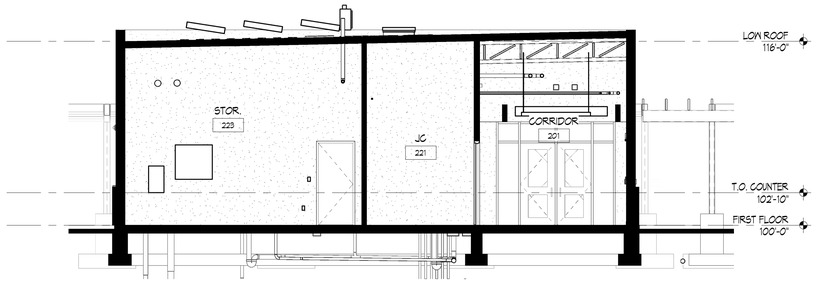


3 BUILDING SECTION - UNIT 200

3/16" = 1'-0" REFER TO 1 / A1.2

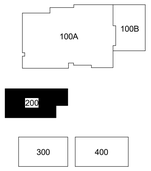
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
BUILDING SECTIONS - UNIT 200

SHEET NO.
A3.6

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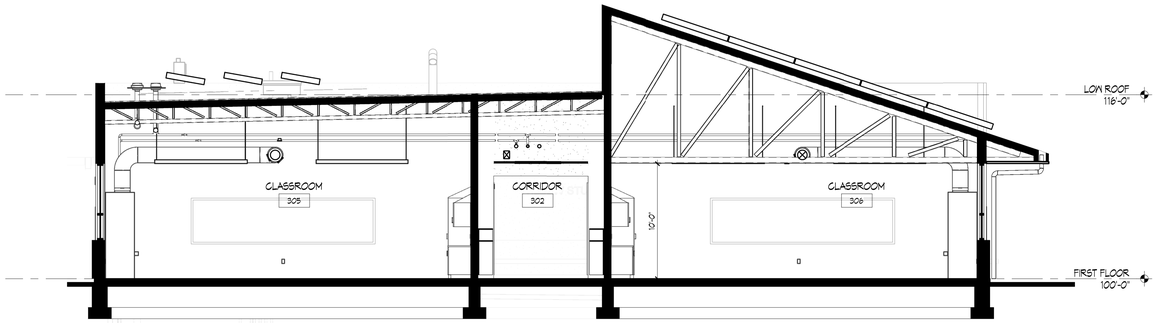
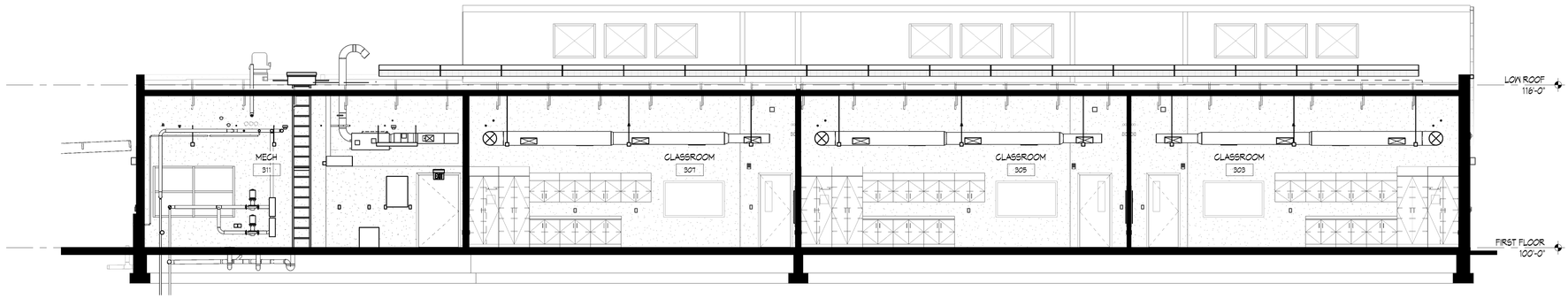


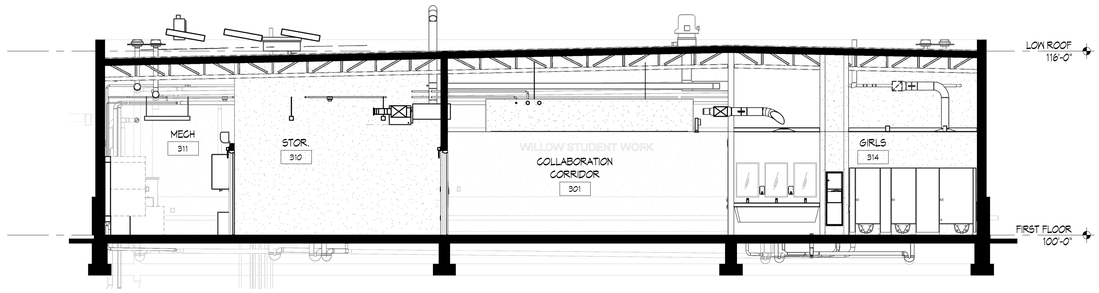
1 BUILDING SECTION - UNIT 300

3/16" = 1'-0" REFER TO 1 / A1.3



2 BUILDING SECTION - UNIT 300

3/16" = 1'-0" REFER TO 1 / A1.3



3 BUILDING SECTION - UNIT 300

3/16" = 1'-0" REFER TO 1 / A1.3

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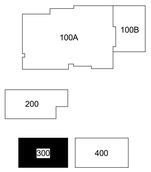
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

N

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE

BUILDING SECTIONS - UNIT 300

SHEET NO.

A3.7

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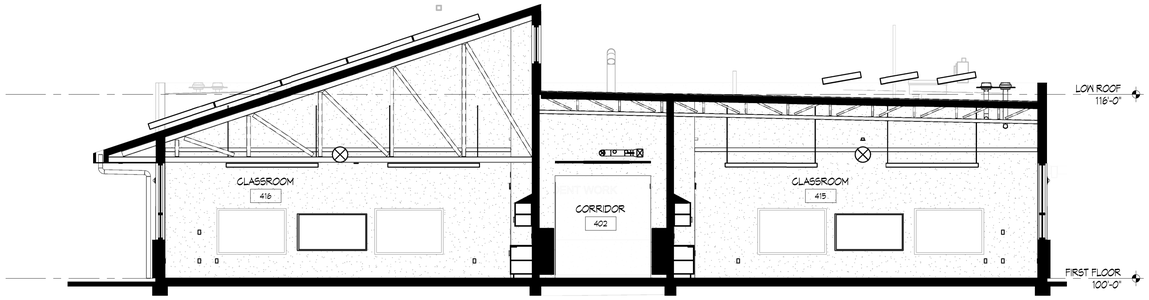
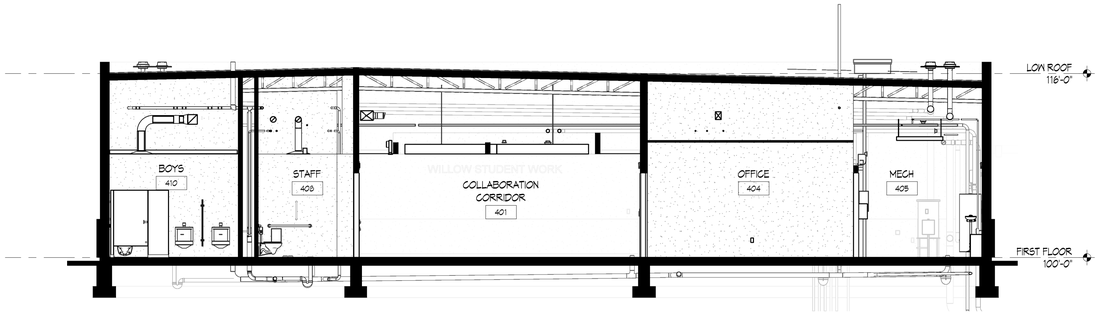


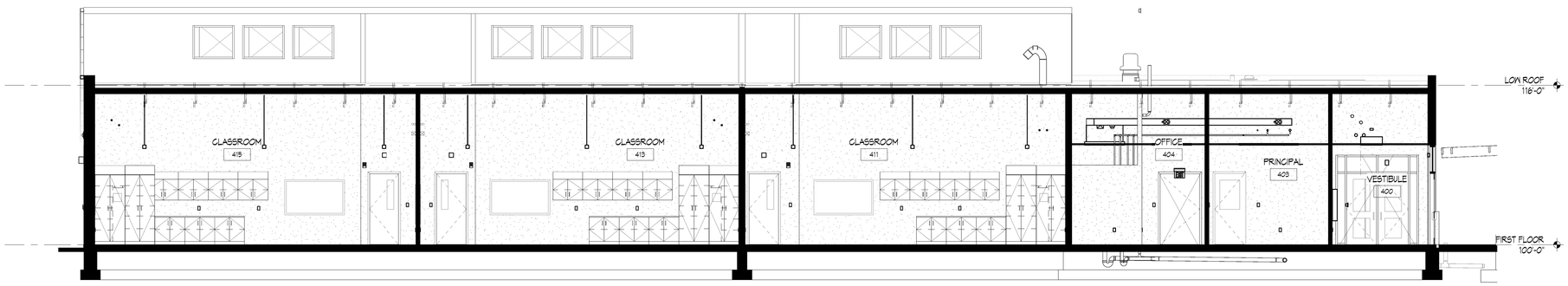
1 BUILDING SECTION - UNIT 400

3/16" = 1'-0" REFER TO 1 / A1.4



2 BUILDING SECTION - UNIT 400

3/16" = 1'-0" REFER TO 1 / A1.4



3 BUILDING SECTION - UNIT 400

3/16" = 1'-0" REFER TO 1 / A1.4

KINGSCOTT

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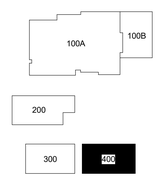
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

BUILDING SECTIONS - UNIT 400

SHEET NO.

A3.8

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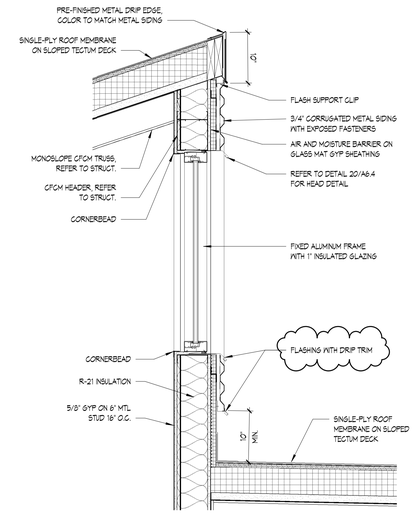
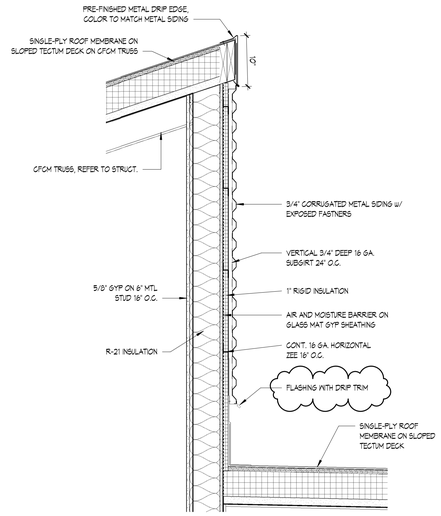


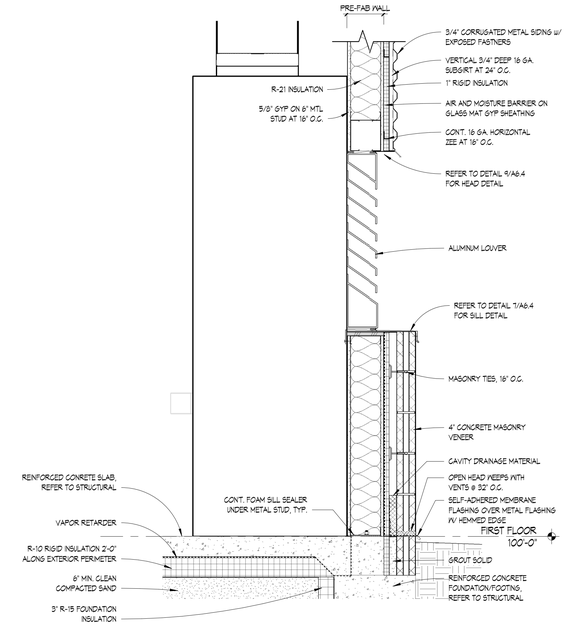
7 PANEL TYPE "G" - CLERESTORY

1" = 1'-0" REFER TO 1 / A0.2



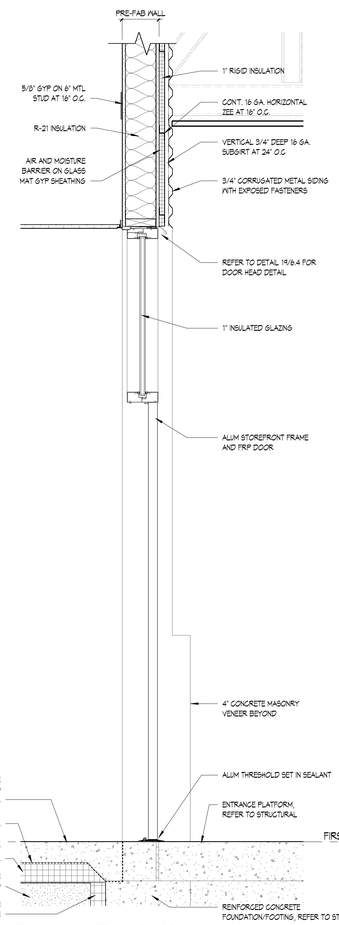
6 PANEL TYPE "F"

1" = 1'-0" REFER TO 1 / A0.2



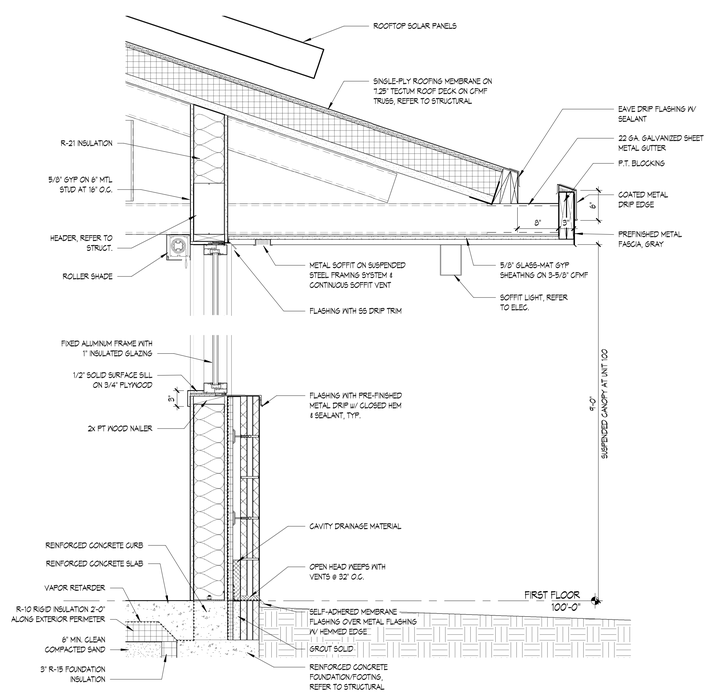
5 PANEL TYPE "E" - LOUVER

1" = 1'-0" REFER TO 1 / A1.3



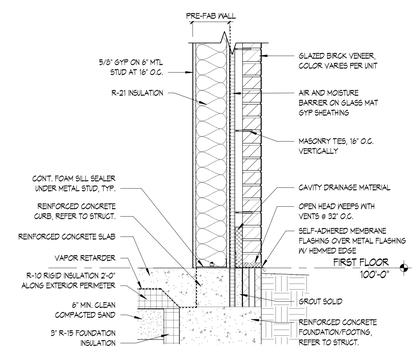
3 PANEL TYPE "C" - DOOR AT CORRUGATED METAL PANEL

1" = 1'-0" REFER TO 1 / A1.1A



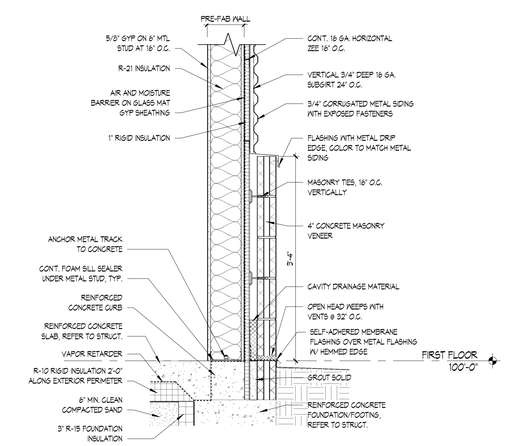
2 PANEL TYPE "B" - WINDOW

1" = 1'-0" REFER TO 1 / A1.1A



4 PANEL TYPE "D"

1" = 1'-0" REFER TO 1 / A1.2



1 PANEL TYPE "A"

1" = 1'-0" REFER TO 1 / A1.2

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024

LSD SB-005
JOB 2616.01A

SHEET TITLE
WALL SECTIONS

SHEET NO.
A4.1

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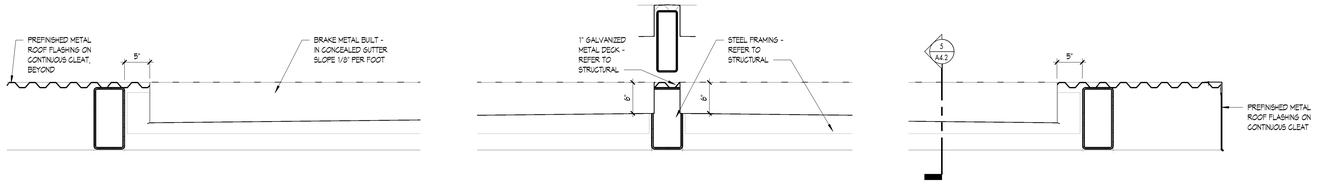
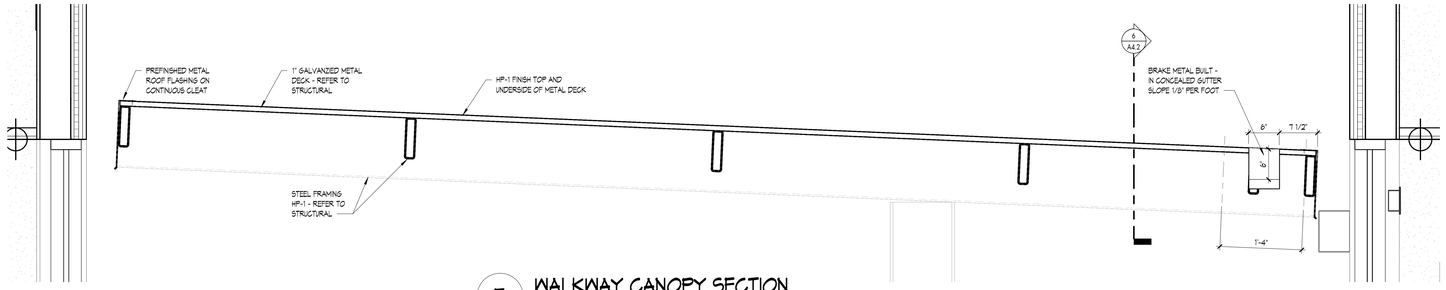


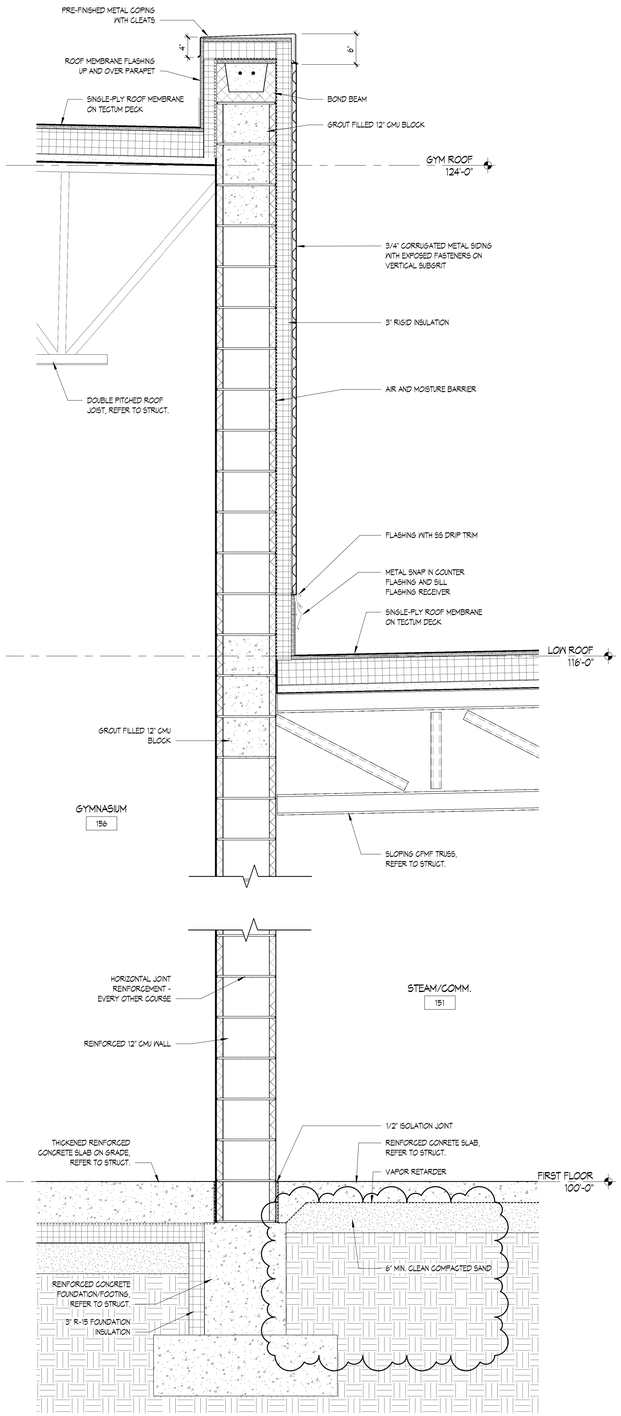
6 WALKWAY CANOPY SECTION

1" = 1'-0" REFER TO 1 / A0.3



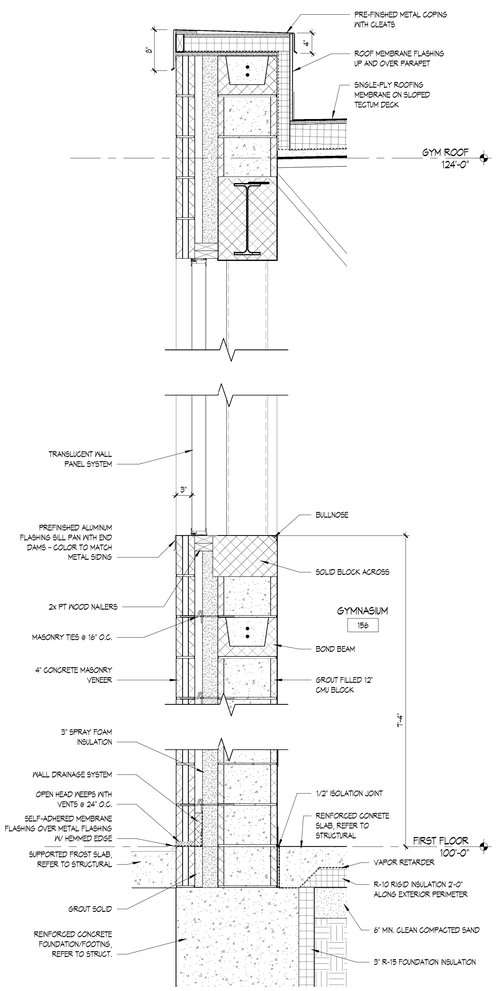
5 WALKWAY CANOPY SECTION

1" = 1'-0" REFER TO 1 / A0.3



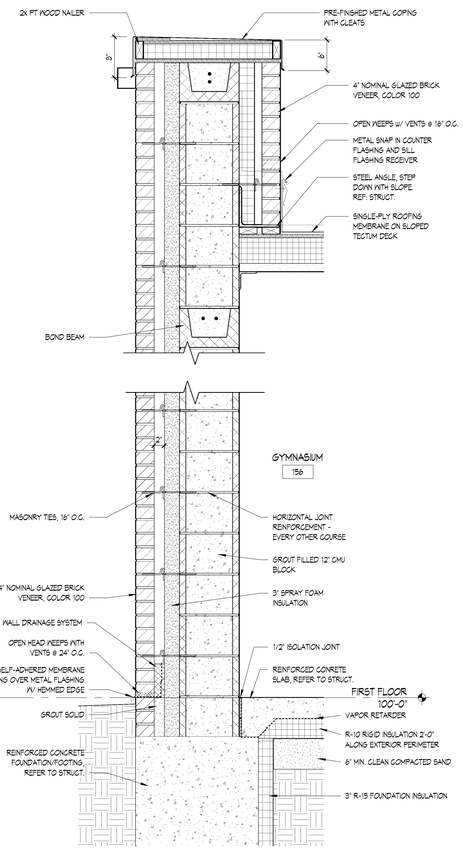
4 GYM WALL SECTION

1" = 1'-0" REFER TO 1 / A0.1



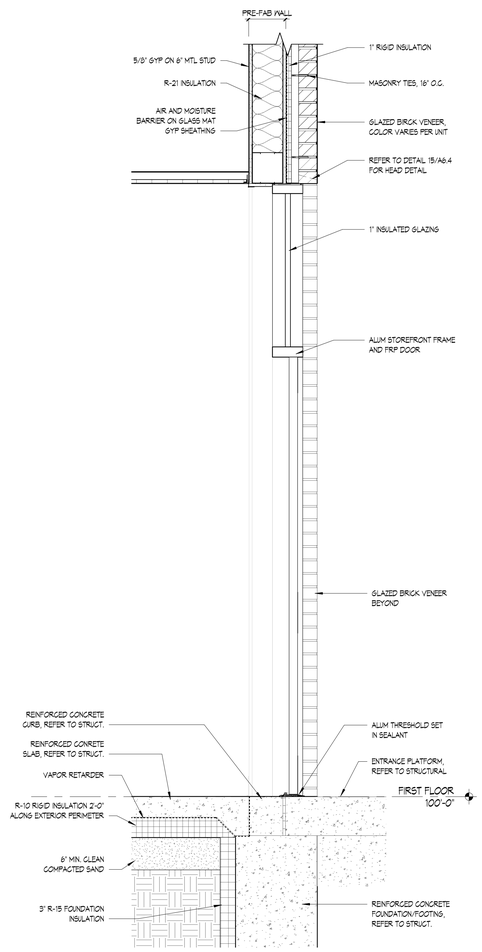
3 GYMNASIUM TRANSLUCENT PANEL

1" = 1'-0" REFER TO 1 / A1.1A



2 GYMNASIUM FEATURE WALL

1" = 1'-0" REFER TO 1 / A1.1A



1 PANEL TYPE 'H' - DOOR AT MASONRY WALL

1" = 1'-0" REFER TO 1 / A1.4

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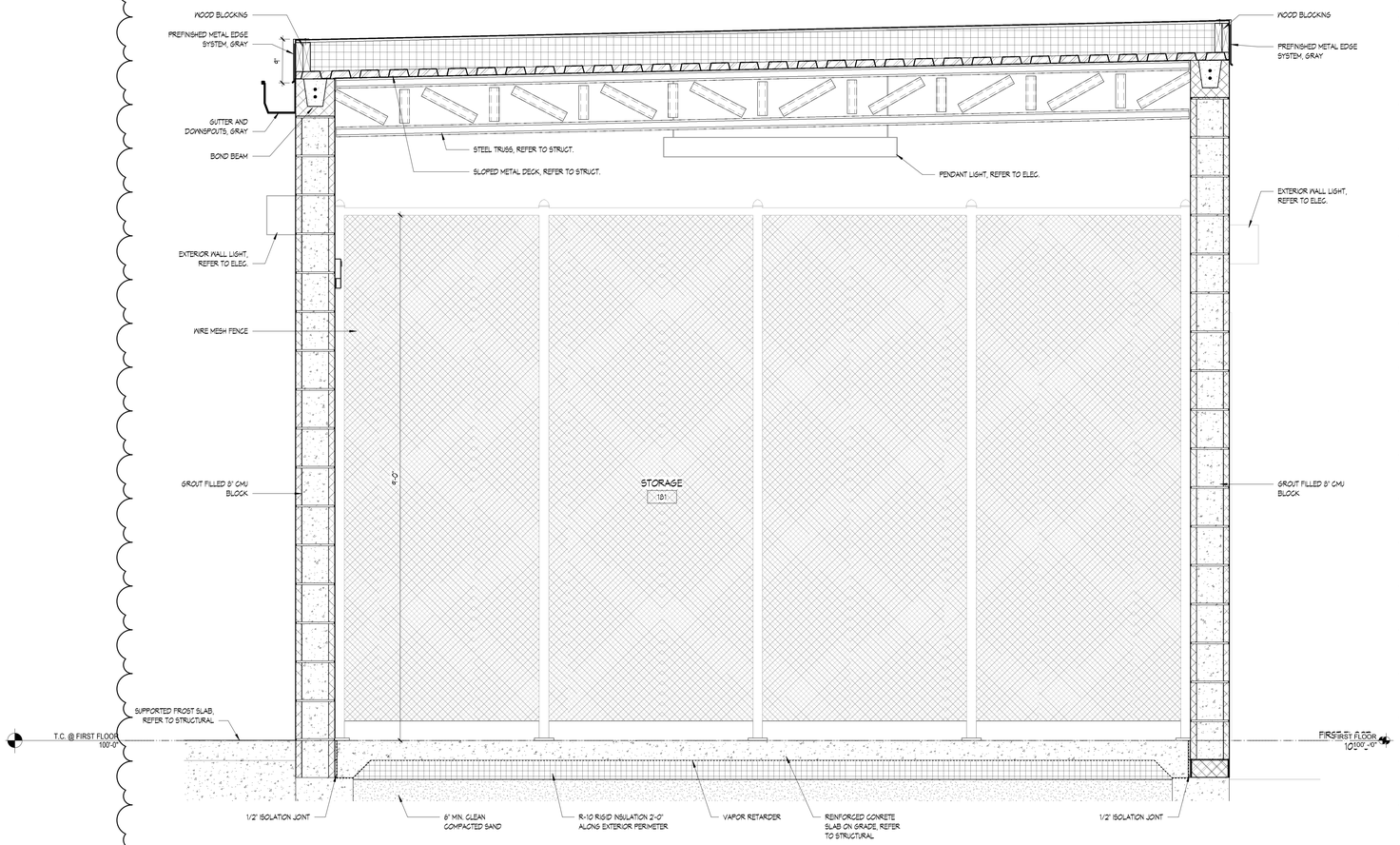
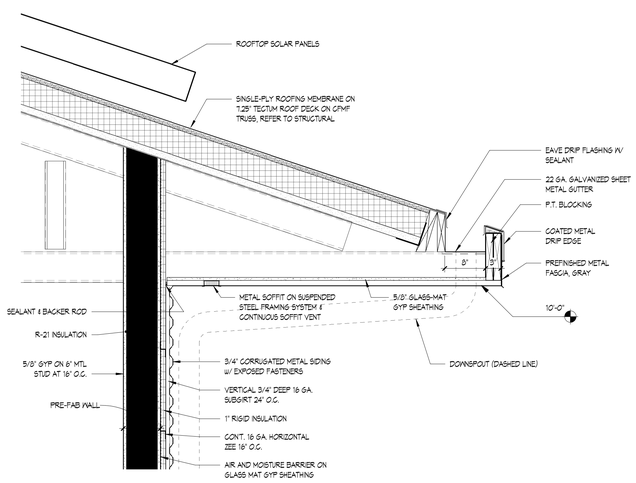


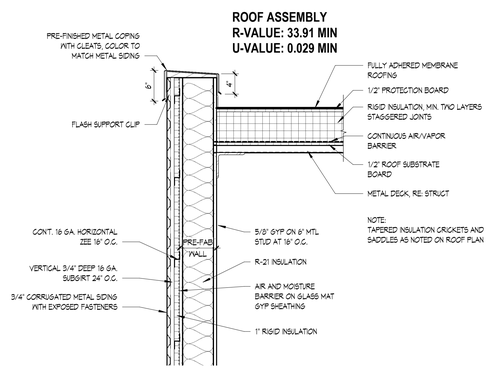
4 EXTERIOR STORAGE ROOM SECTION

1" = 1'-0" REFER TO 1 / A1.1B



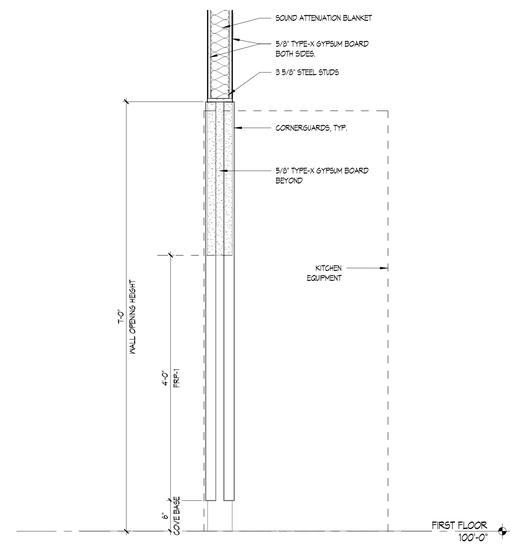
3 SUSPENDED CANOPY - UNITS 200, 300, 400

1" = 1'-0" REFER TO 1 / A0.1



2 METAL ROOF DECK

1" = 1'-0" REFER TO 1 / A2.1A



1 KITCHEN WALL OPENING DETAIL

1" = 1'-0" REFER TO 1 / A1.1A

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Lansing School District

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Addendum 01	03/01/2024
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JOB 2616.01A

SHEET TITLE
WALL SECTIONS

SHEET NO.
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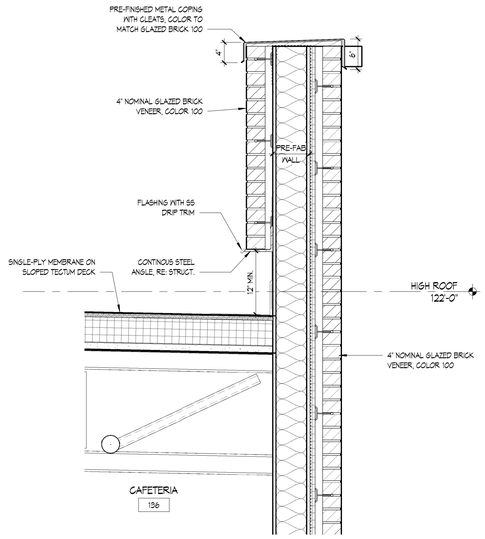
Willow School

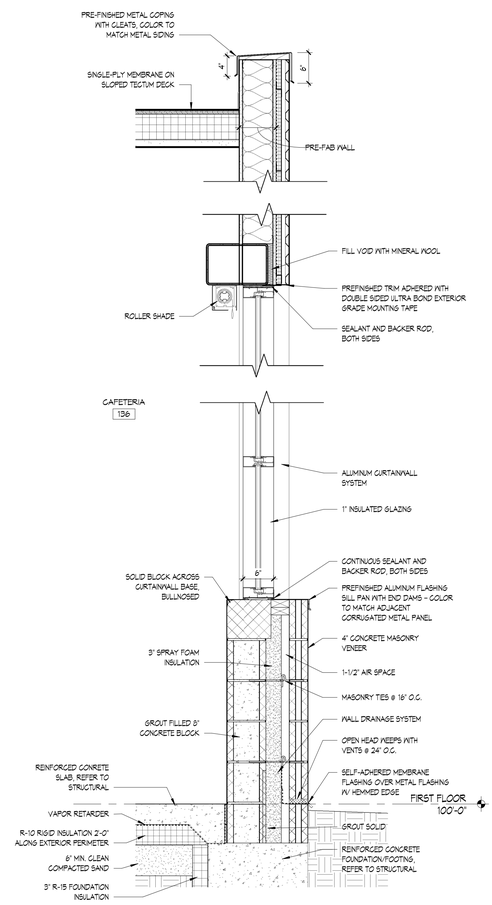
Lansing School District

1012 W. Willow
Lansing, MI 48915



2 CAFETERIA FEATURE WALL

1" = 1'-0" REFER TO 1 / A2.1A



1 CAFETERIA CURTAINWALL

1" = 1'-0" REFER TO 1 / A1.1A

Lansing School District

ISSUANCES	DATE
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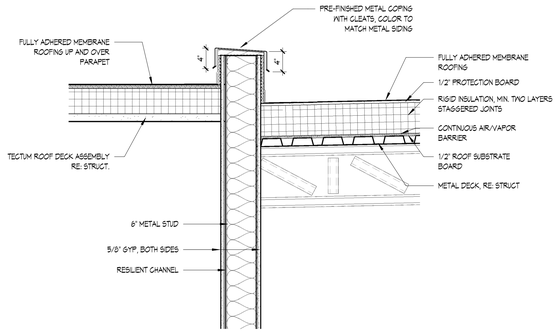
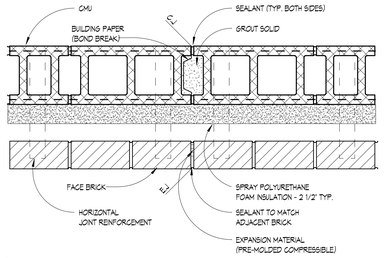


9 ROOF SECTION

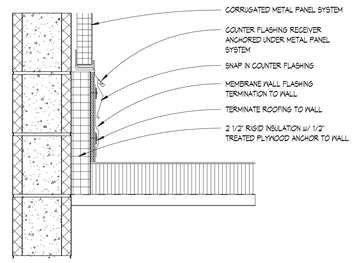
1" = 1'-0"

REFER TO 1 / A0.2



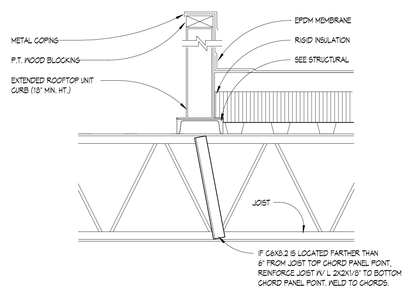
8 WALL MOVEMENT JOINT

1 1/2" = 1'-0"



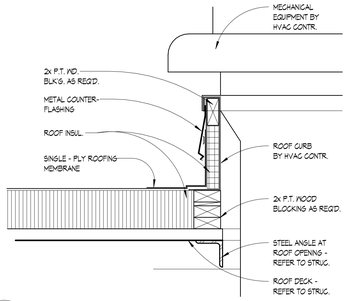
7 ROOF/WALL FLASHING

1 1/2" = 1'-0"



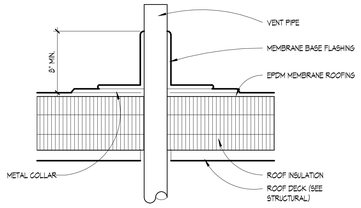
6 ROOF EQUIPMENT CURB

1 1/2" = 1'-0"



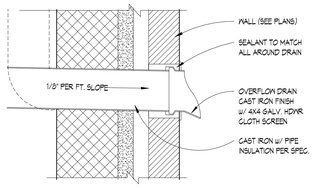
5 TYPICAL MECHANICAL CURB

1 1/2" = 1'-0"



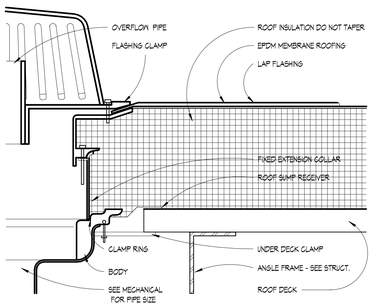
4 TYPICAL ROOF VENT DETAIL

1 1/2" = 1'-0"



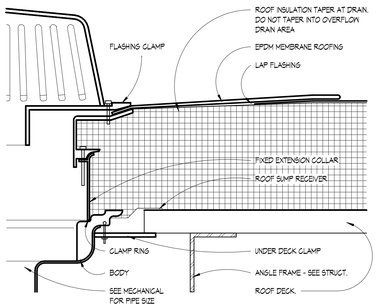
3 SCUPPER DETAIL

1 1/2" = 1'-0"



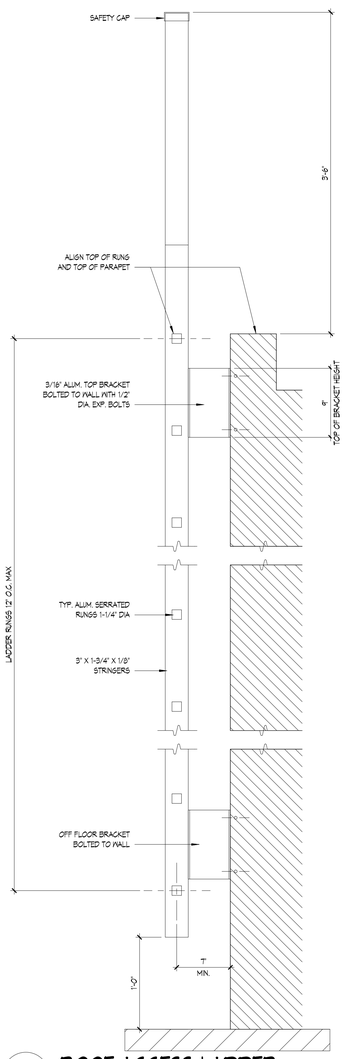
2 OVERFLOW DRAIN DETAIL

3" = 1'-0"



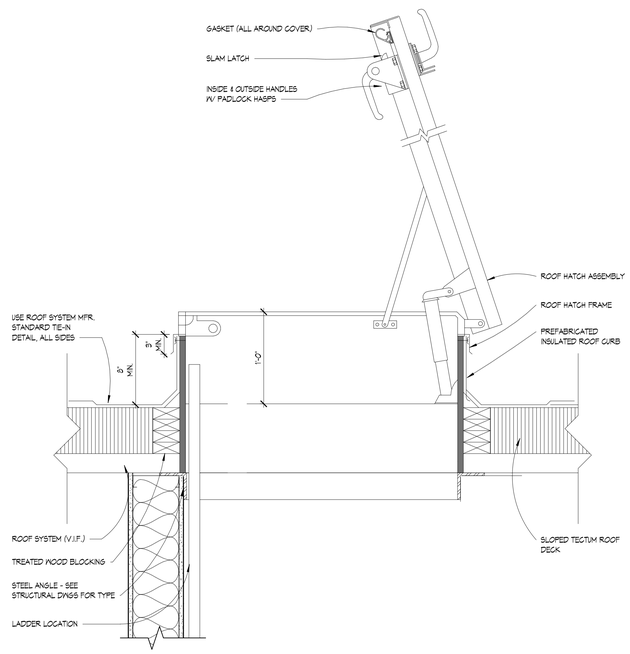
1 ROOF DRAIN DETAIL

3" = 1'-0"



11 ROOF ACCESS LADDER

1 1/2" = 1'-0"



10 ROOF HATCH

1 1/2" = 1'-0"

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Willow School

Lansing School District

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Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

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JOB NO. 2616.01A

SHEET TITLE
BUILDING DETAILS

SHEET NO.
A5.1

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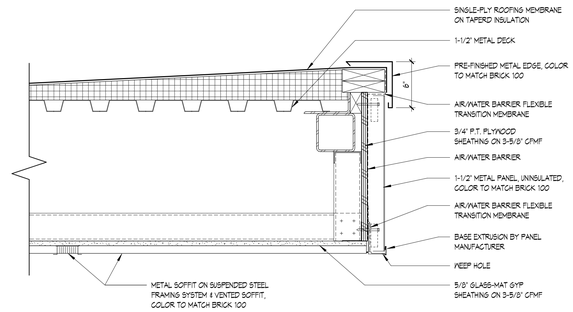
Willow School

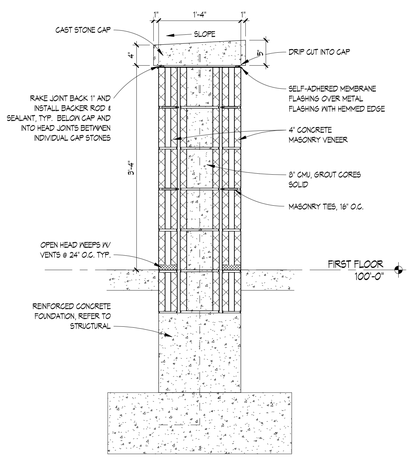
Lansing School District

1012 W. Willow
Lansing, MI 48915



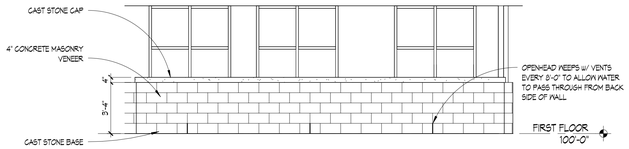
8 ENTRY CANOPY SECTION - UNIT 100

1 1/2" = 1'-0" REFER TO 1 / A0.3



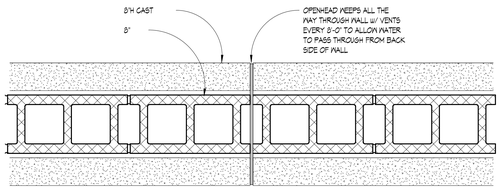
5 LOW WALL SECTION

1" = 1'-0" REFER TO 4 / A5.2



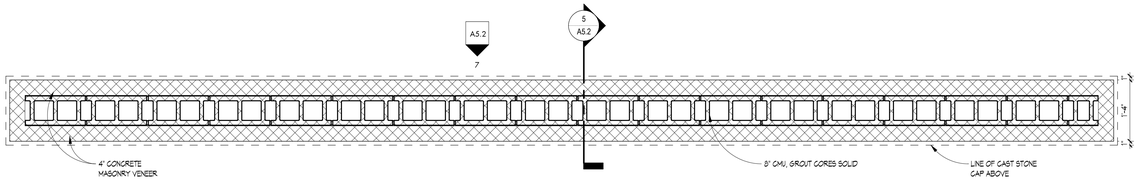
7 LOW WALL ELEVATION

1/4" = 1'-0" REFER TO 4 / A5.2



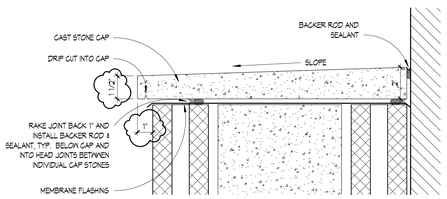
6 LOW WALL BASE PLAN DETAIL

1 1/2" = 1'-0"



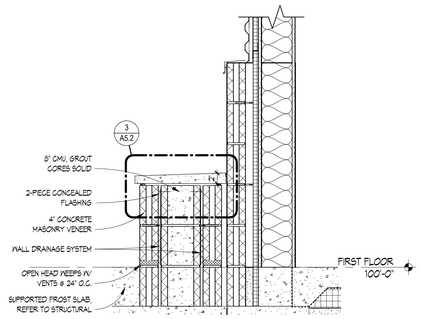
4 LOW WALL PLAN DETAIL

3/4" = 1'-0" REFER TO 1 / A1.1A



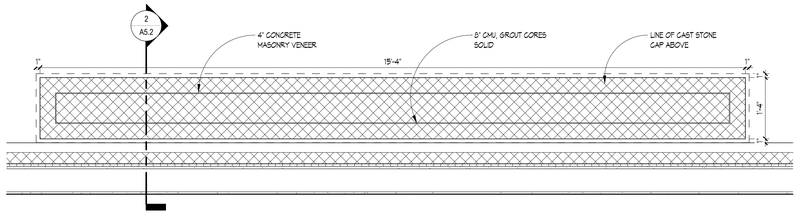
3 BENCH CAP DETAIL

3" = 1'-0" REFER TO 2 / A5.2



2 BENCH SECTION

1" = 1'-0" REFER TO 1 / A5.2



1 BENCH PLAN DETAIL

3/4" = 1'-0" REFER TO 1 / A1.1A

Lansing School District

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SHEET TITLE BUILDING DETAILS

SHEET NO. A5.2

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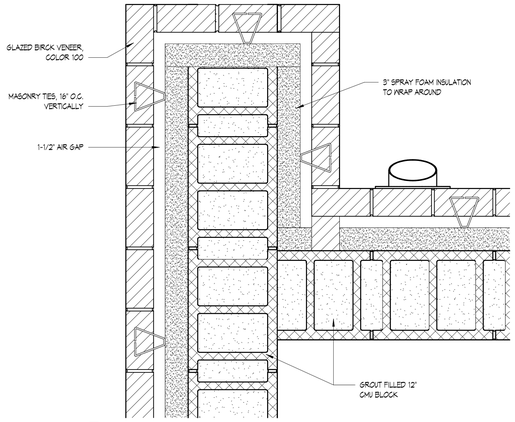
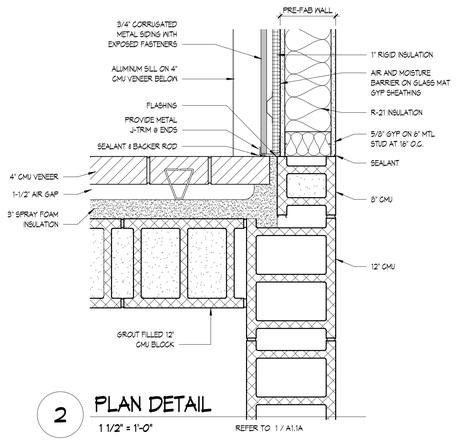
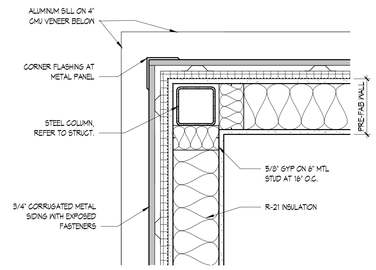


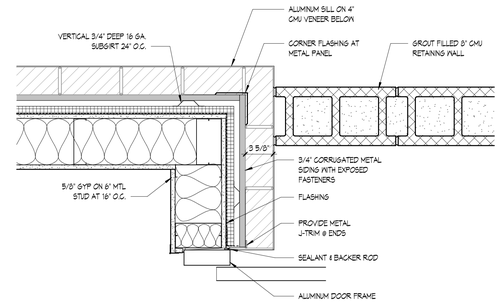
1 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



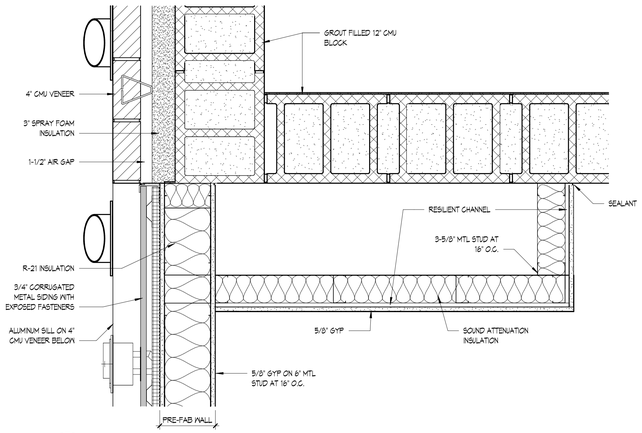
2 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



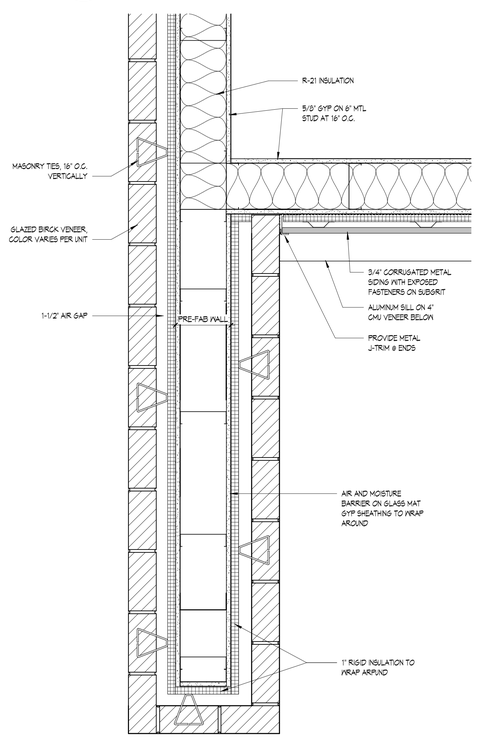
3 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



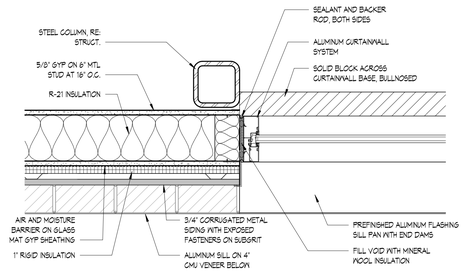
4 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



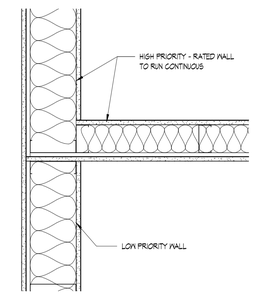
7 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



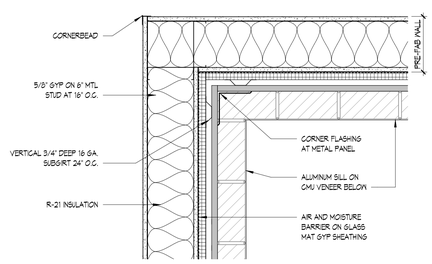
6 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



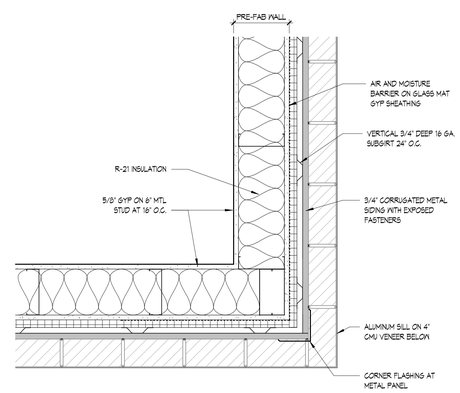
11 CURTAINWALL JAMB DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A



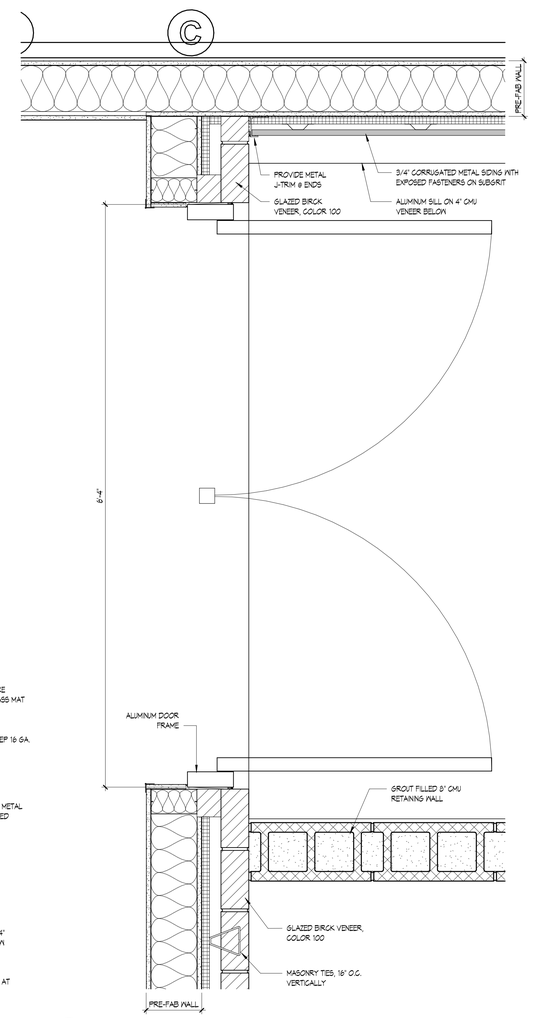
10 ABUTMENT OF DISSIMILAR WALLS
1 1/2" = 1'-0" REFER TO 1 / A1.1A



9 PLAN DETAIL - INSIDE CORNER
1 1/2" = 1'-0" REFER TO 1 / A1.2



8 PLAN DETAIL - OUTSIDE CORNER
1 1/2" = 1'-0" REFER TO 1 / A1.2



5 PLAN DETAIL
1 1/2" = 1'-0" REFER TO 1 / A1.1A

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
BUILDING DETAILS

SHEET NO.
A5.3

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KINGSCOTT
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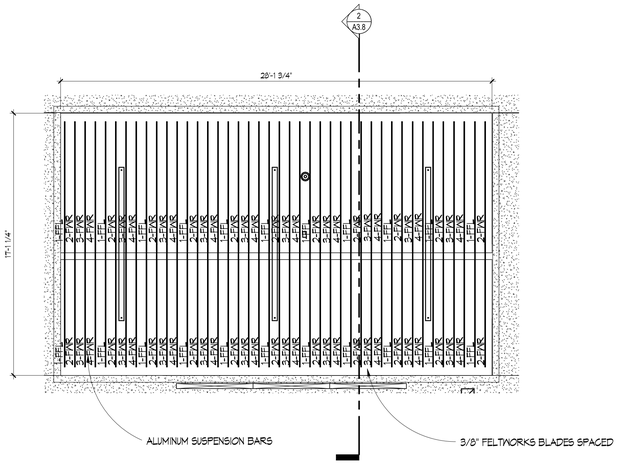
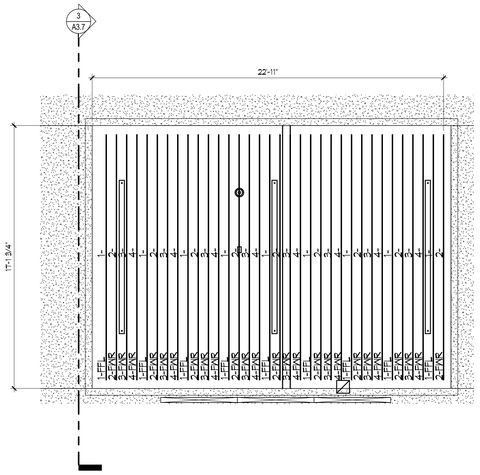
Willow School

Lansing School District

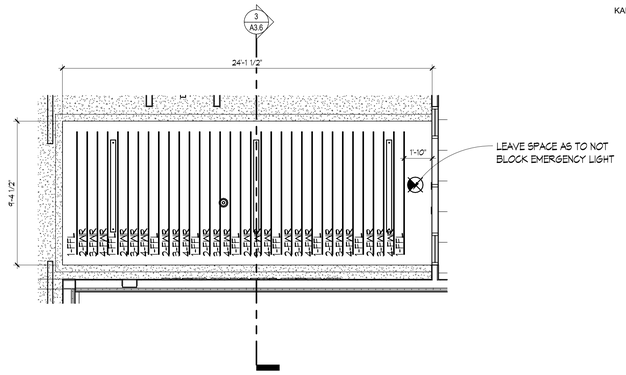
1012 W. Willow
Lansing, MI 48915



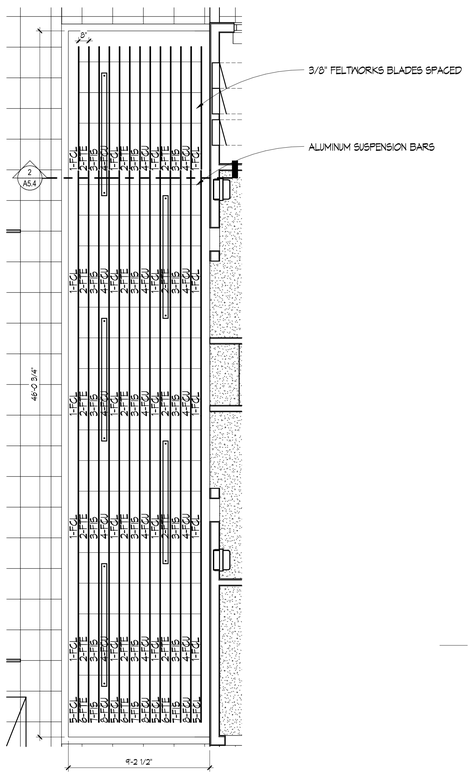
8 FIRST FLOOR RCP - UNIT 400 - Callout 1
1/4" = 1'-0"



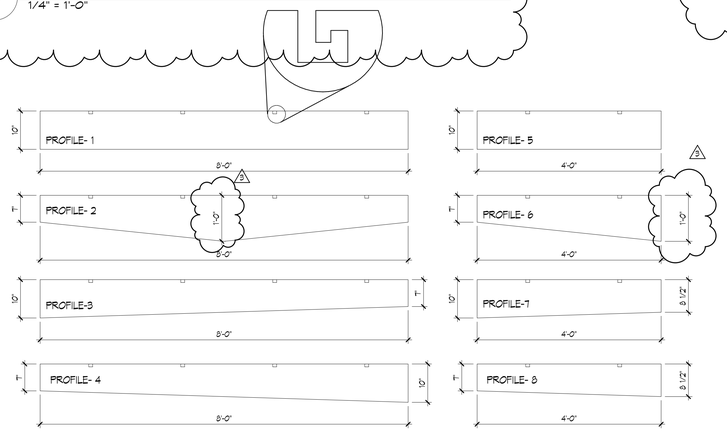
7 FIRST FLOOR RCP - UNIT 300 - Callout 1
1/4" = 1'-0"



6 FIRST FLOOR RCP - UNIT 200 - Callout 1
1/4" = 1'-0"



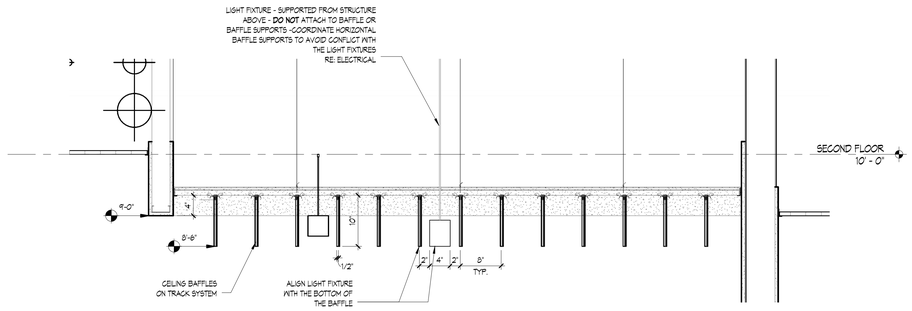
3 BAFFLE CEILING RCP-UNIT 100
1/4" = 1'-0"



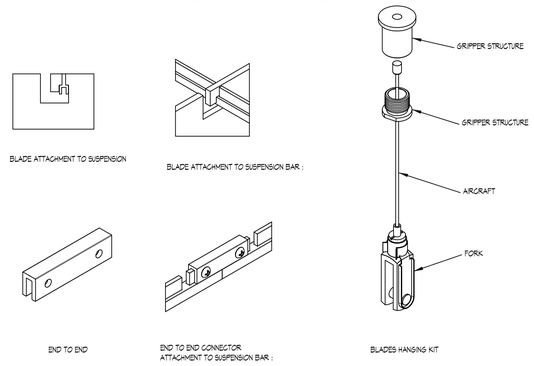
5 ACOUSTICAL BAFFLE
3/4" = 1'-0"

ARMSTRONG FELTWORKS

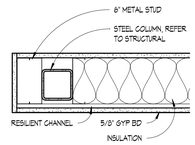
COLOR	TAG
FCL-CELESTRIAL	PROFILE #-
FTE-TANGERINE	COLOR
FIS-IRIS	
FCU-CUSTOM PURPLE	
FWR-WHISPER	
FFL-FLANNEL	



2 BAFFLE CEILING SECTION
1" = 1'-0"
REFER TO 1 / A2.1A



4 BAFFLE CONNECTION
NTS



1 COLUMN AT INTERIOR WALL
1 1/2" = 1'-0"
REFER TO 1 / A1.1A

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024

LSD SB-005
JOB 2616.01A

SHEET TITLE: BUILDING DETAILS

SHEET NO.: A5.4

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PLEASE RECYCLE

DOOR SCHEDULE

DOOR NUMBER	DOOR					FRAME							FIRE RATING	HARDWARE SET	REMARKS
									DETAILS						
	WIDTH	HEIGHT	DOOR TYPE	DOOR MATERIAL	DOOR GLASS	FRAME TYPE	FRAME MATERIAL	FRAME GLASS	HEAD	JAMB	JAMB	SILL			
100A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	4	ALUM	1" INSUL.	5/A6.4	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		49	CARD READER
100B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
100C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
100D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
100E	3'-0"	7'-2"	FG2	FRP	1" INSUL.	4	ALUM	1" INSUL.	19/A6.	18/A6.4 SIM	18/A6.4 SIM	--		46	CARD READER
100F	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
100G	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
100H	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
101A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	9	ALUM	1" INSUL.	19/A6.4	18/A6.4 SIM	18/A6.4 SIM	--		48	
101B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
101C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
101D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		46	
101E	3'-0"	7'-2"	FG2	FRP	1" INSUL.	9	ALUM	1" INSUL.	5/A6.4	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		52	
101F	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
101G	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
101H	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		51	CARD READER
102A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	10	ALUM	1" INSUL.	5/A6.4	2/A6.4	2/A6.4	1/A6.4 SIM		53	CARD READER
102B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	10	ALUM	1" INSUL.	"	"	"	"		58	
102C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	7	ALUM	1" INSUL.	19/A6.4	18/A6.4 SIM	2/A6.4 SIM	--		36	
102D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		36	
108A	3'-0"	7'-2"	G	FRP	1" INSUL.	2	ALUM	1" INSUL.	14/A6.3	13/A6.3	12/A6.3	--		30	
108B	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		31	CARD READER
110	3'-8"	7'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		03	
111	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
112	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
113	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		08	
114	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		09	
115A	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		29	CARD READER
115B	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
116A	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		01	
116B	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		01	
117	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		32	CARD READER
118	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		26	CARD READER
119	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	16	
120A	6'-0"	7'-2"	F	HM	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	25	
120B	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	22	
121A	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	39	
121B	4'-0"	8'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		59	
123A	6'-0"	7'-2"	F	HM	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	23	
123B	6'-0"	7'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		57	CARD READER
124	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	22	
125	3'-0"	7'-2"	F	WD	--	3	HM	1/4" SAF	15/A6.4	13/A6.3	12/A6.3	--		28	CARD READER
126	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
128	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
129	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
130	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
131	6'-0"	7'-2"	F	HM	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	25	
132	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	17	
133	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	15	
135A	4'-0"	8'-0"	-	STL	--	--	STL		20/A6.3	19/A6.3	19/A6.3	--		61	OVERHEAD COILING DOOR
135B	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	02	
135C	4'-0"	8'-0"	-	STL	--	--	STL		20/A6.3	19/A6.3	19/A6.3	--		61	OVERHEAD COILING DOOR
135D	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		10	
135E	9'-0"	8'-0"	-	STL	--	--	STL		20/A6.3	19/A6.3	19/A6.3	--		61	OVERHEAD COILING DOOR
136A	6'-0"	7'-2"	FG2	WD	1/4" SAF	1A	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	45	KEYED REMOVABLE MULLION; CARD READER
136B	5'-0"	4'-8"	-	STL	--	--	STL							61	COUNTER COILING DOOR
136C	6'-0"	7'-2"	F	FRP	--	1A	ALUM	--	15/A6.4	12/A6.4	12/A6.4	1/A6.4		55	KEYED REMOVABLE MULLION; CARD READER
136D	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		54	FIXED MULLION; CARD READER
136E	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		58	FIXED MULLION
136F	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		54	FIXED MULLION; CARD READER
136G	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		58	FIXED MULLION
137	6'-0"	7'-2"	F	HM	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	19	
138A	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	27	CARD READER
138B	6'-0"	7'-2"	F	HM	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	20	
139A	6'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		43	CARD READER
139B	6'-0"	7'-2"	F	HM	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		44	CARD READER
139C	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		59	FIXED MULLION
139D	3'-0"	7'-2"	F	FRP	--	1A	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		59	FIXED MULLION
140	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
141A	6'-0"	7'-2"	N8	WD	1/4" SAF	1A	HM	--	14/A6.3	13/A6.3	13/A6.3	--		42	KEYED REMOVABLE MULLION; CARD READER
141B	3'-0"	7'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		59	
143	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	14	
144	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	14	
145A	6'-0"	7'-2"	N8	WD	1/4" SAF	1A	HM	--	14/A6.3	13/A6.3	13/A6.3	--		42	KEYED REMOVABLE MULLION; CARD READER
145B	3'-0"	7'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4		59	
146	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		01	
147	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
148	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		08	
149	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		08	
150	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		08	
151A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
151B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
152	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		06	
153	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	12	
154	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	33	
155A	3'-0"	7'-2"	F	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		26	CARD READER
155B	15'-0"	7'-0"	-	WD	--									62	SLIDING WALL, 4 PANELS
156A	3'-0"	7'-2"	FG2	WD	1/4" SAF	5	HM	--	15/A6.4	13/A6.3	12/A6.3	--		41	GALVANIZED FRAME; CARD READER
156B	6'-0"	7'-2"	FG2	WD	1/4" SAF	1	HM	--	14/A6.3	12/A6.3	12/A6.3	--		38	
156D	6'-0"	7'-2"	F	FRP	--	1	ALUM	--	4/A6.4	3/A6.4	3/A6.4	1/A6.4		56	CARD READER
156E	6'-0"	7'-2"	F	FRP	--	1	ALUM	--	4/A6.4	3/A6.4	3/A6.4	1/A6.4		60	
157	4'-0"	7'-2"	F	WD	--	1	HM	--	4/A6.3	3/A6.3	3/A6.3	--	45 MIN.	13	

DOOR SCHEDULE

DOOR NUMBER	DOOR					FRAME							FIRE RATING	HARDWARE SET	REMARKS
									DETAILS						
	WIDTH	HEIGHT	DOOR TYPE	DOOR MATERIAL	DOOR GLASS	FRAME TYPE	FRAME MATERIAL	FRAME GLASS	HEAD	JAMB	JAMB	SILL			
158	3'-0"	7'-2"	F	WD	--	1	HM	--	4/A6.3	3/A6.3	3/A6.3	--		11	
159	3'-0"	7'-2"	F	WD	--	1	HM	--	4/A6.3	3/A6.3	3/A6.3	--		07	
160	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		06	
161	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	3/A6.3	--		06	
162	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		06	
163	3'-0"	7'-2"	F	WD	--	1	HM	--	4/A6.3	3/A6.3	3/A6.3	--		11	
164	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		09	
180	3'-0"	7'-2"	F	FRP	--	1	ALUM	--	5/A6.4 SIM	2/A6.4 SIM	2/A6.4 SIM	1/A6.4 SIM		34	
181A	6'-0"	7'-2"	F	FRP	--	1	ALUM	--	14/A6.4	13/A6.4	13/A6.4	--		35	CARD READER
181B	6'-0"	7'-2"	F	FRP	--	1	ALUM	--	14/A6.4	13/A6.4	13/A6.4	--		35	
200A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	11	ALUM	1" INSUL.	5/A6.4	2/A6.4	2/A6.4	1/A6.4		50	CARD READER
200B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
200C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	8	ALUM	1" INSUL.	19/A6.4	18/A6.4	18/A6.4	--		47	CARD READER
200D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
201A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	6	ALUM	1" INSUL.	15/A6.4	12/A6.4	12/A6.4	1/A6.4		58	
201B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		53	CARD READER
202A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
202B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
204	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
205A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
205B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
207	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
208A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
208B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
210	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
211A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
211B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
213	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
214A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
214B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
216	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
217A	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		37	
217B	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		40	CARD READER
219	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		04	
220	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
221	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
222	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	24	
223	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
300A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	10	ALUM	1" INSUL.	5/A6.4	2/A6.4	2/A6.4	1/A6.4		50	CARD READER
300B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
300C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	7	ALUM	1" INSUL.	19/A6.4	18/A6.4	18/A6.4	--		47	CARD READER
300D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		48	
302A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	6	ALUM	1" INSUL.	15/A6.4	12/A6.4	12/A6.4	1/A6.4		58	
302B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		53	CARD READER
303	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
304	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
305	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
306	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
307	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
308	3'-0"	7'-2"	N8	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
309	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
310	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	22	
311	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	22	
312	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
313	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
400A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	10	ALUM	1" INSUL.	5/A6.4	2/A6.4	2/A6.4	1/A6.4		50	CARD READER
400B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		52	
400C	3'-0"	7'-2"	FG2	FRP	1" INSUL.	7	ALUM	1" INSUL.	19/A6.4	18/A6.4	18/A6.4	--		48	
400D	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		47	CARD READER
402A	3'-0"	7'-2"	FG2	FRP	1" INSUL.	6	ALUM	1" INSUL.	15/A6.4	12/A6.4	12/A6.4	1/A6.4		53	CARD READER
402B	3'-0"	7'-2"	FG2	FRP	1" INSUL.	"	ALUM	1" INSUL.	"	"	"	"		58	
403	3'-0"	7'-2"	G	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		08	
404	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	18	
405	4'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	22	
406	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--	45 MIN.	21	
407	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
408	3'-0"	7'-2"	F	WD	--	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		05	
411	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
412	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
413	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
414	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
415	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER
416	3'-0"	7'-2"	N8	WD	1/4" SAF	1	HM	--	14/A6.3	13/A6.3	13/A6.3	--		28	CARD READER

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 01	03/01/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
DOOR SCHEDULE

SHEET NO.
A6.1

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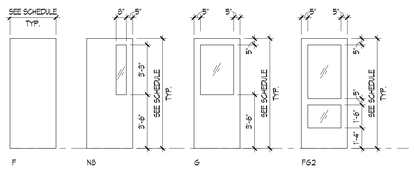
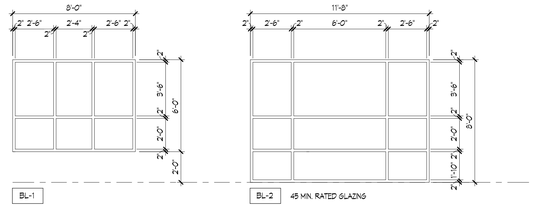


DOOR TYPES

FIELD VERIFY OPENING SIZE PRIOR TO MANUFACTURING



BORROWED LITE FRAMES

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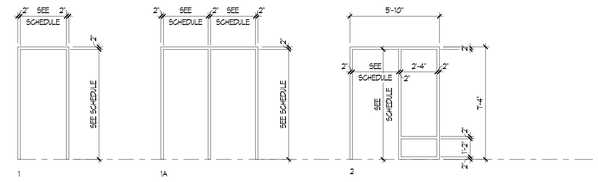

FRAME TYPES

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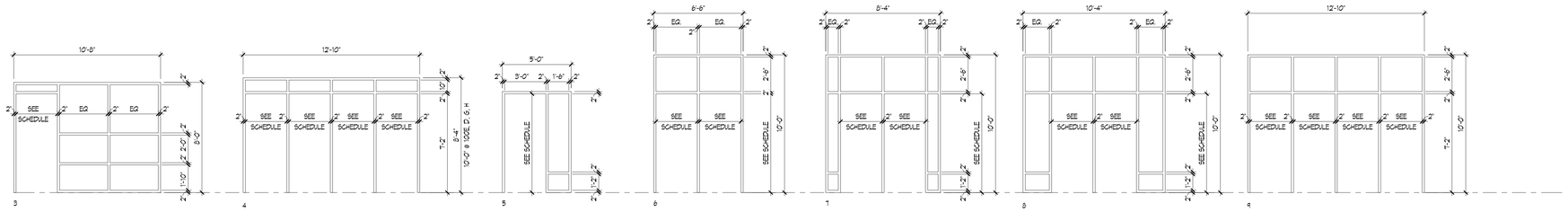
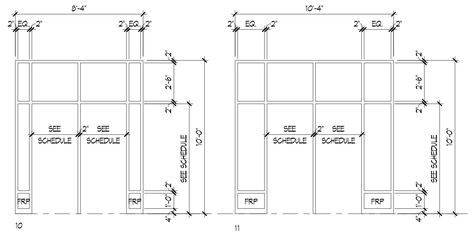
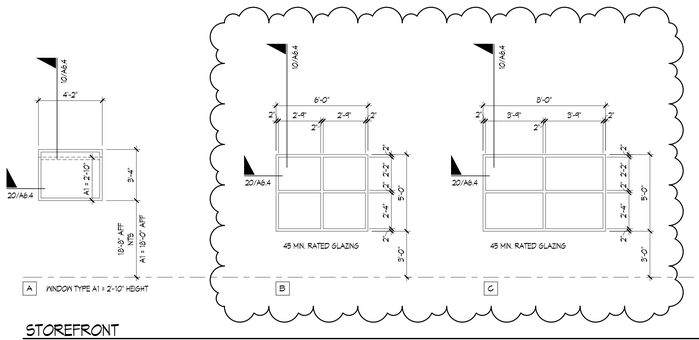




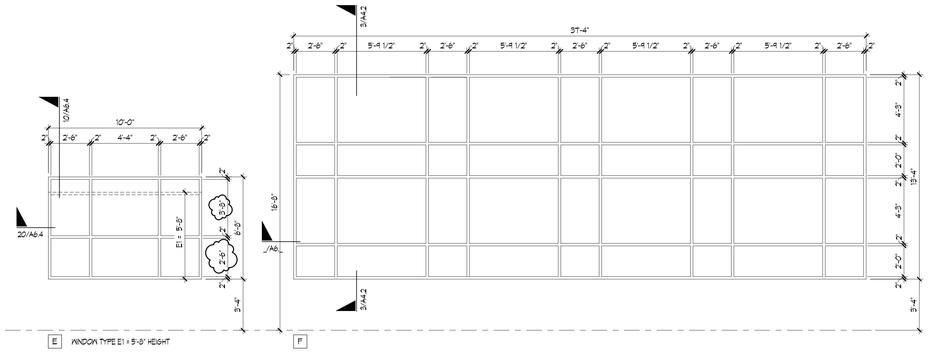
FRAME TYPES

FIELD VERIFY OPENING SIZE PRIOR TO MANUFACTURING
FRP COLOR TO MATCH DOOR



STOREFRONT

FIELD VERIFY OPENING SIZE PRIOR TO MANUFACTURING



CURTAINWALL

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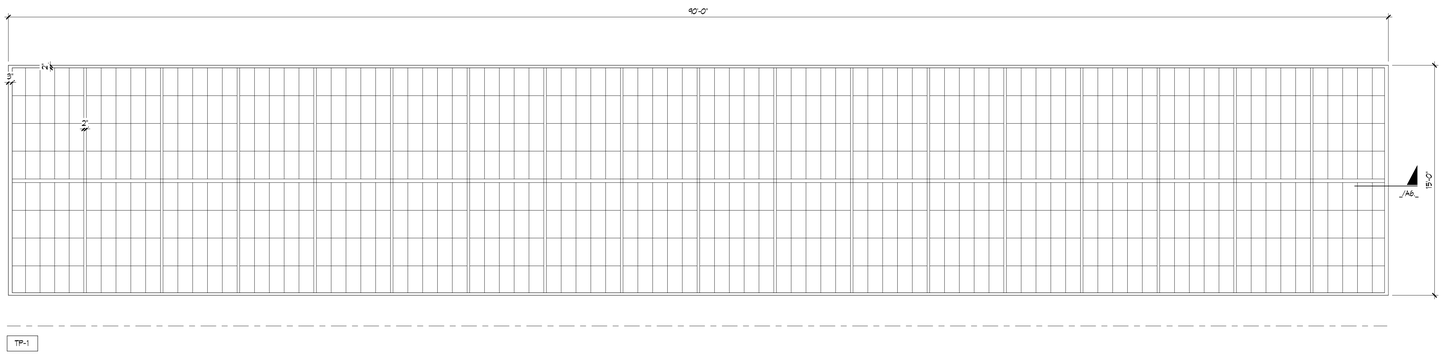

TRANSLUCENT PANEL

FIELD VERIFY OPENING SIZE PRIOR TO MANUFACTURING

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 01	03/01/2024
PR-01	04/19/2024

LSD SB-005
JOB 2616.01A

SHEET TITLE
OPENING ELEVATIONS

SHEET NO.
A6.2

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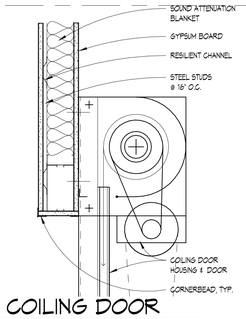
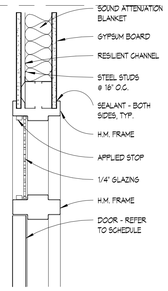


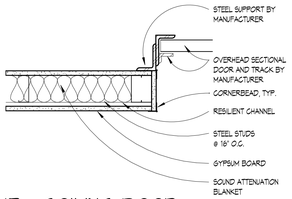
20 HEAD - COILING DOOR
1 1/2" = 1'-0"



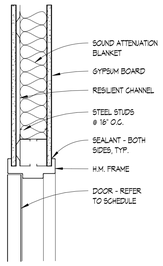
15 HEAD - HM FRAME
1 1/2" = 1'-0" 6 1/4" HM FRAME REQUIRED

10 NOT USED

5 NOT USED

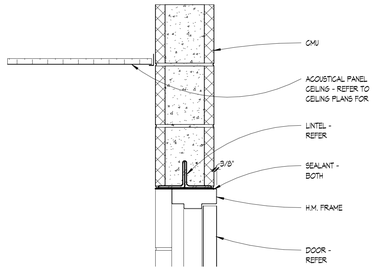


19 JAMB - COILING DOOR
1 1/2" = 1'-0"



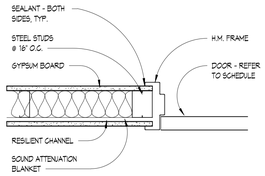
14 HEAD - HM FRAME
1 1/2" = 1'-0" 6 1/4" HM FRAME REQUIRED

9 NOT USED

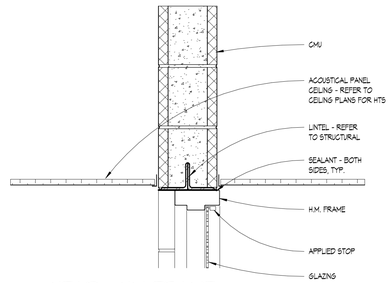


4 HEAD - HM FRAME
1 1/2" = 1'-0"

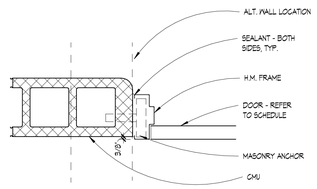
18 NOT USED



13 JAMB - HM FRAME
1 1/2" = 1'-0" 6 1/4" HM FRAME REQUIRED

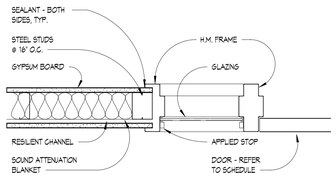


8 HEAD - HM FRAME
1 1/2" = 1'-0"

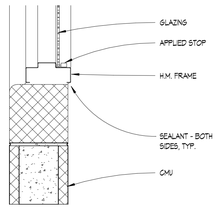


3 JAMB - HM FRAME
1 1/2" = 1'-0" BULLNOSE CMU @ JAMBS, TYP.

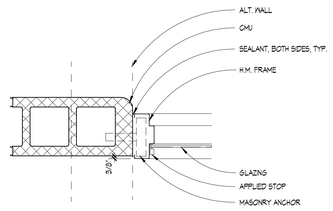
17 NOT USED



12 JAMB - HM FRAME
1 1/2" = 1'-0" 6 1/4" HM FRAME REQUIRED

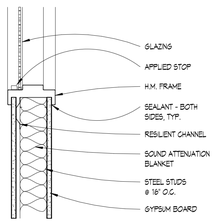


7 SILL - HM FRAME
1 1/2" = 1'-0" BULLNOSE CMU @ SILLS, TYP., U.N.O.



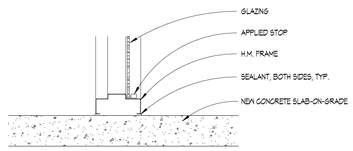
2 JAMB - HM FRAME
1 1/2" = 1'-0" BULLNOSE CMU @ JAMBS, TYP.

16 NOT USED



11 SILL - HM FRAME
1 1/2" = 1'-0" 6 1/4" HM FRAME REQUIRED

6 NOT USED



1 JAMB - HM FRAME
1 1/2" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
DOOR & WINDOW DETAILS

SHEET NO.
A6.3

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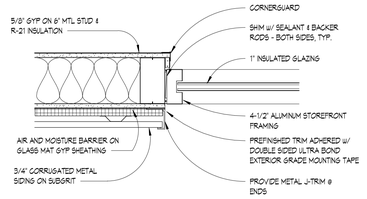
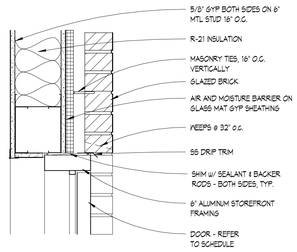
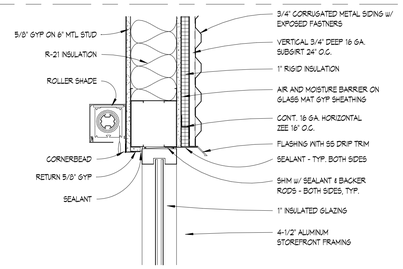


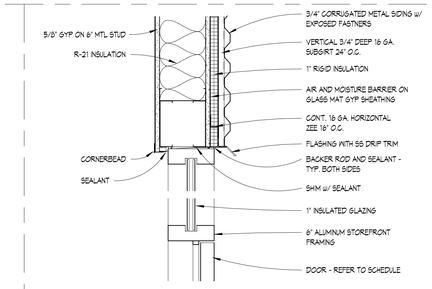
20 JAMB - ALUMINUM FRAME
1 1/2" = 1'-0"



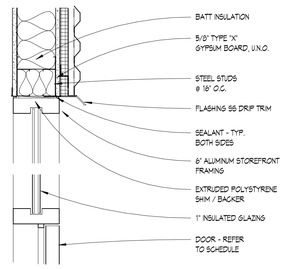
15 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



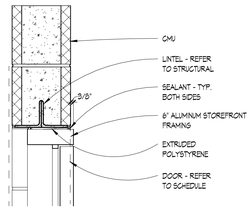
10 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



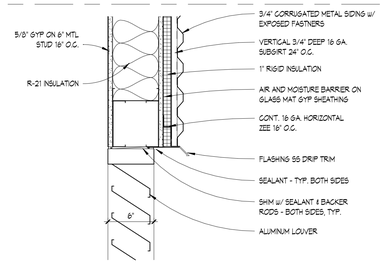
5 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



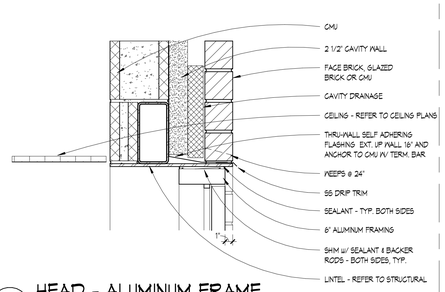
19 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



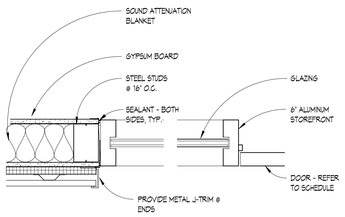
14 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



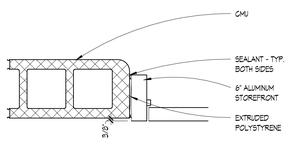
9 HEAD - LOUVER
1 1/2" = 1'-0"



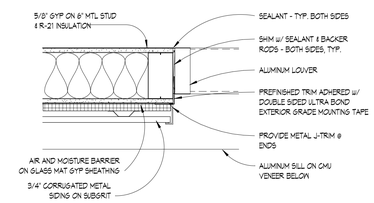
4 HEAD - ALUMINUM FRAME
1 1/2" = 1'-0"



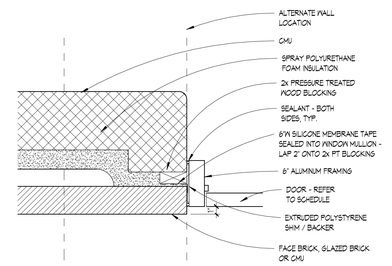
18 JAMB - ALUMINUM FRAME
1 1/2" = 1'-0"



13 JAMB - ALUMINUM FRAME
1 1/2" = 1'-0"
BULLNOSE CMU @ JAMBS,

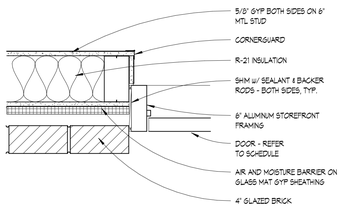


8 JAMB - LOUVER
1 1/2" = 1'-0"

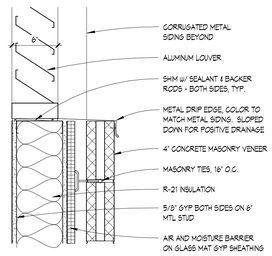


3 JAMB - ALUMINUM FRAME
1 1/2" = 1'-0"

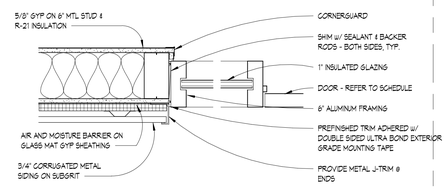
17 NOT USED



12 JAMB - ALUMINUM FRAME



7 SILL - LOUVER
1 1/2" = 1'-0"

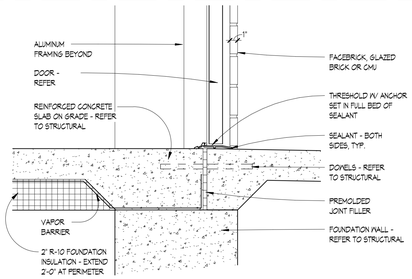


2 JAMB - ALUMINUM FRAME
1 1/2" = 1'-0"

16 NOT USED

11 NOT USED

6 NOT USED
1 1/2" = 1'-0"



1 SILL - ALUMINUM FRAME
1 1/2" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
DOOR & WINDOW DETAILS

SHEET NO.
A6.4

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WARNING: ELECTRONIC FORMAT 11.5.17 - PM
C:\Users\jeffpc\Desktop\Willow_Revit_Models\willow_CENTRAL - 2020_jeffpc.rvt

COLOR LAYOUT PLAN GENERAL NOTES

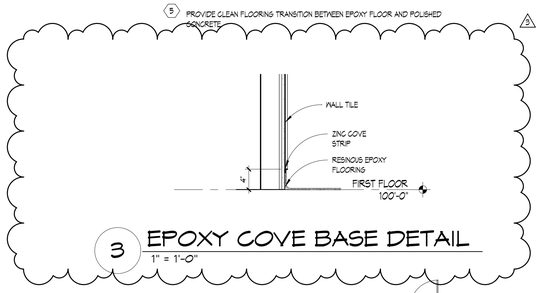
1. SEE REFLECTED CEILING PLANS FOR ACOUSTICAL CEILING TYPES.
2. UNLESS NOTED OTHERWISE, PAINT NEW BULKHEADS, GYP CEILINGS, AND EXPOSED CEILINGS IN COLORS INDICATED ON THE REFLECTED CEILING PLANS AND COLOR LAYOUT PLANS.
3. AT EXPOSED SEALED CONCRETE, PROVIDE HEAVY DUTY SEMI-RIGID EPOXY JOINT FILLER. CONTROL JOINTS AT POLISHED CONCRETE 10' X 10' OR AS NOTED ON COLOR PLANS.
4. FLOORING TRANSITIONS TO OCCUR IN LINE WITH THE CENTERLINE OF THE DOOR LEAF. PROVIDE A CLEAN TRANSITION BETWEEN POLISHED AND SEALED CONCRETE FLOORS.
5. PAINT EXPOSED DOMESTIC WATER PIPING P-1 U.N.O.
6. PAINT EXPOSED FIRE SUPPRESSION LINE PIPING P-5 U.N.O.
7. PAINT EXPOSED GEOTHERMAL LINE PIPING P-3 U.N.O.
8. PAINT EXPOSED ELECTRICAL CONDUIT P-4 U.N.O.
9. AT EXPOSED CEILING, PAINT STRUCTRUAL ELEMENTS TO MATCH COLOR INDICATED.
10. VERIFY LETTERING FONT AND SIZES WITH OWNER IN FIELD.
11. ALL WINDOW SILLS TO RECEIVE WHITE SOLID SURFACE U.N.O.
12. PAINT ALL HM FRAMES AND DOORS P-3 U.N.O.
13. ALL RESINOUS EPOXY FLOORS TO HAVE INTEGREL RESINOUS EPOXY BASE U.N.O.

COLOR LAYOUT PLAN LEGEND

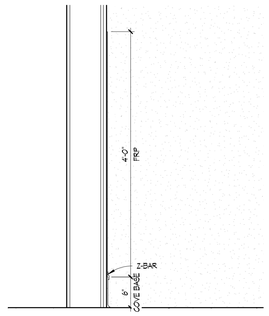
- PAINT, SEE SPECIFICATION SECTIONS 099123 & 099600
- MATCH EXISTING ADJ. COLOR
- CERAMIC FLOOR TILE, SEE SPECIFICATION SECTION 093013
- CERAMIC TILE WALL, SEE SPECIFICATION SECTION 093013
- RESILIENT athletic FLOORING, SEE SPECIFICATION SECTION 096566
- NTEGRAL PIGMENTED CONCRETE FLOORING, SEE SPECIFICATION SECTION 033543
- LUXURY VINYL TILE, SEE SPECIFICATION SECTION 096519
- C.T. — CARPET TILE, SEE SPECIFICATION SECTION 096680
- MT — BARRIER FREE METAL TRANSITION EQUAL TO SCHLUTER RENO-RAMP
- P.C. — POLISHED CONCRETE FLOOR, (SALT & PEPPER)
- RB-# — RUBBER BASE, SEE SPECIFICATION SECTION 096513
- REF-# — RESINOUS EPOXY FLOORING
- RT — RESILIENT TRANSITION, SEE SPECIFICATION SECTION 096513
- S.C. — SEALED CONCRETE FLOOR
- ST.C. — STAINED CONCRETE FLOOR
- CONTROL JOINT
- PRODUCT EXTENTS WITH MATERIAL INDICATED
- WP — WORK POINT
- FLOORING TRANSITION
- MATERIAL INSTALL DIRECTION
- A | B — CHANGE OF MATERIAL

COLOR LAYOUT PLAN KEYNOTES

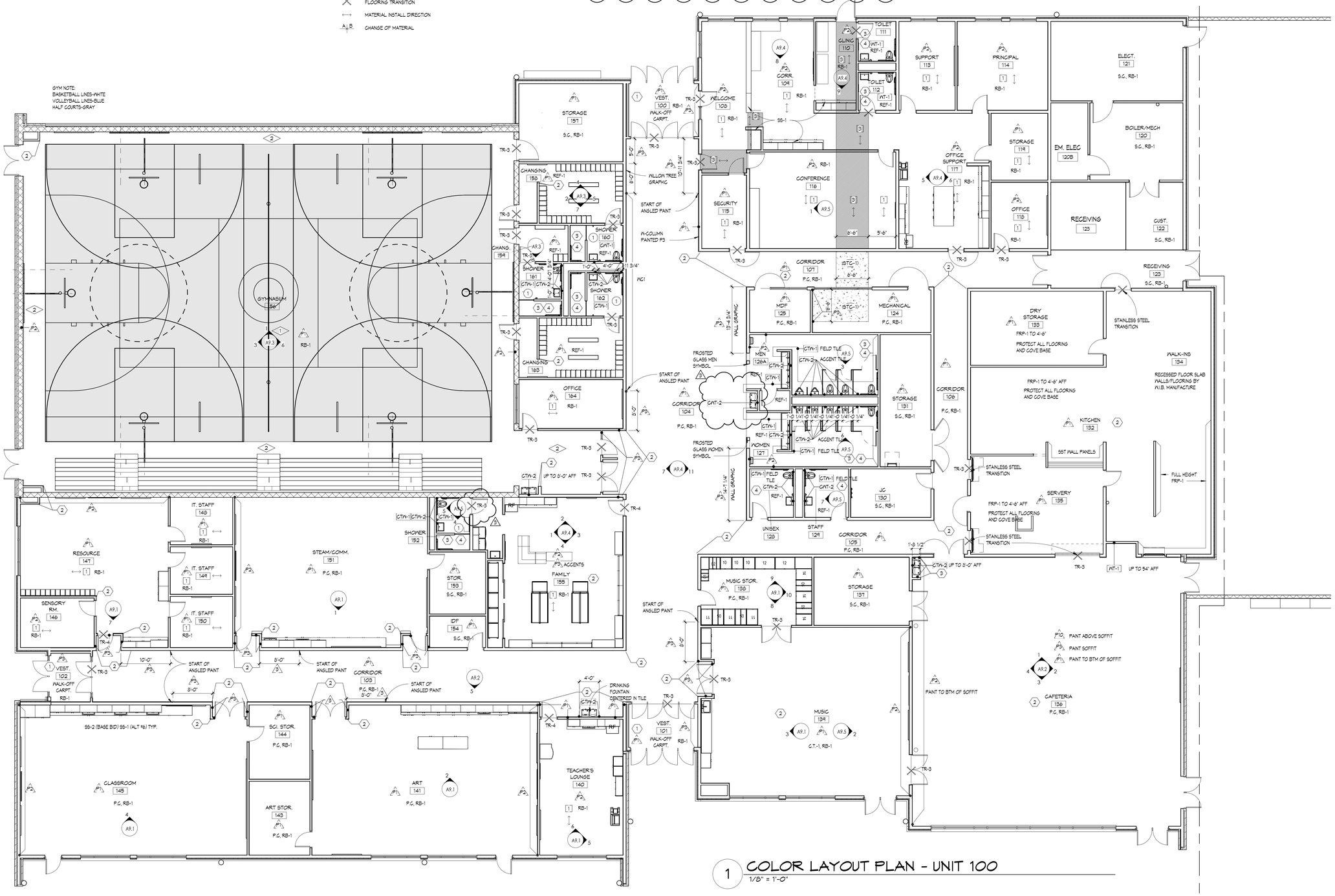
1. WALKOFF CPT WITH RB-1.
2. ALUMINUM CORNER GUARD, 5'-0" H - MOUNT 4'A.F.F.
3. METAL TRIM AT EXPOSED CORNERS OF WALL TILE
4. FULL HEIGHT WALL TILE
5. PROVIDE CLEAN FLOORING TRANSITION BETWEEN EPOXY FLOOR AND POLISHED CONCRETE



3 EPOXY COVE BASE DETAIL
1" = 1'-0"



2 KITCHEN BASE DETAIL
1" = 1'-0"



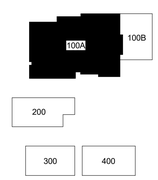
1 COLOR LAYOUT PLAN - UNIT 100
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 01	03/01/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A
N

SHEET TITLE
COLOR LAYOUT PLAN - UNIT 100

SHEET NO.
A8.1

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LAST PLOTTED: Friday, March 15, 2024 10:10:58 PM
C:\Users\dbrannon\KAD\Documents\Lansing_Willow_Arch_2023_dbrannon5258TN.rvt

COLOR LAYOUT PLAN GENERAL NOTES

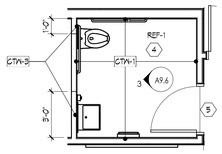
1. SEE REFLECTED CEILING PLANS FOR ACOUSTICAL CEILING TYPES.
2. UNLESS NOTED OTHERWISE, PAINT NON BULKHEADS, GYP CEILINGS, AND EXPOSED CEILINGS IN COLORS INDICATED ON THE REFLECTED CEILING PLANS AND COLOR LAYOUT PLANS.
3. AT EXPOSED SEALED CONCRETE, PROVIDE HEAVY DUTY SEMI-RIGID EPOXY JOINT FILLER. CONTROL JOINTS AT POLISHED CONCRETE 10' X 10' OR AS NOTED ON COLOR PLANS.
4. FLOORING TRANSITIONS TO OCCUR IN LINE WITH THE CENTERLINE OF THE DOOR LEAF. PROVIDE A CLEAN TRANSITION BETWEEN POLISHED AND SEALED CONCRETE FLOORS.
5. PAINT EXPOSED DOMESTIC WATER PIPING P-1 U.N.O.
6. PAINT EXPOSED FIRE SUPPRESSION LINE PIPING P-5 U.N.O.
7. PAINT EXPOSED GEOTHERMAL LINE PIPING P-3 U.N.O.
8. PAINT EXPOSED ELECTRICAL CONDUIT P-4 U.N.O.
9. AT EXPOSED CEILING, PAINT STRUCTRUAL ELEMENTS TO MATCH COLOR INDICATED.
10. VERIFY LETTERING FONT AND SIZES WITH OWNER IN FIELD.
11. ALL WINDOW SILLS TO RECEIVE WHITE SOLID SURFACE U.N.O.
12. PAINT ALL HM FRAMES AND DOORS P-8 U.N.O.
13. ALL RESINOUS EPOXY FLOORS TO HAVE INTEGREL RESINOUS EPOXY BASE U.N.O.

COLOR LAYOUT PLAN LEGEND

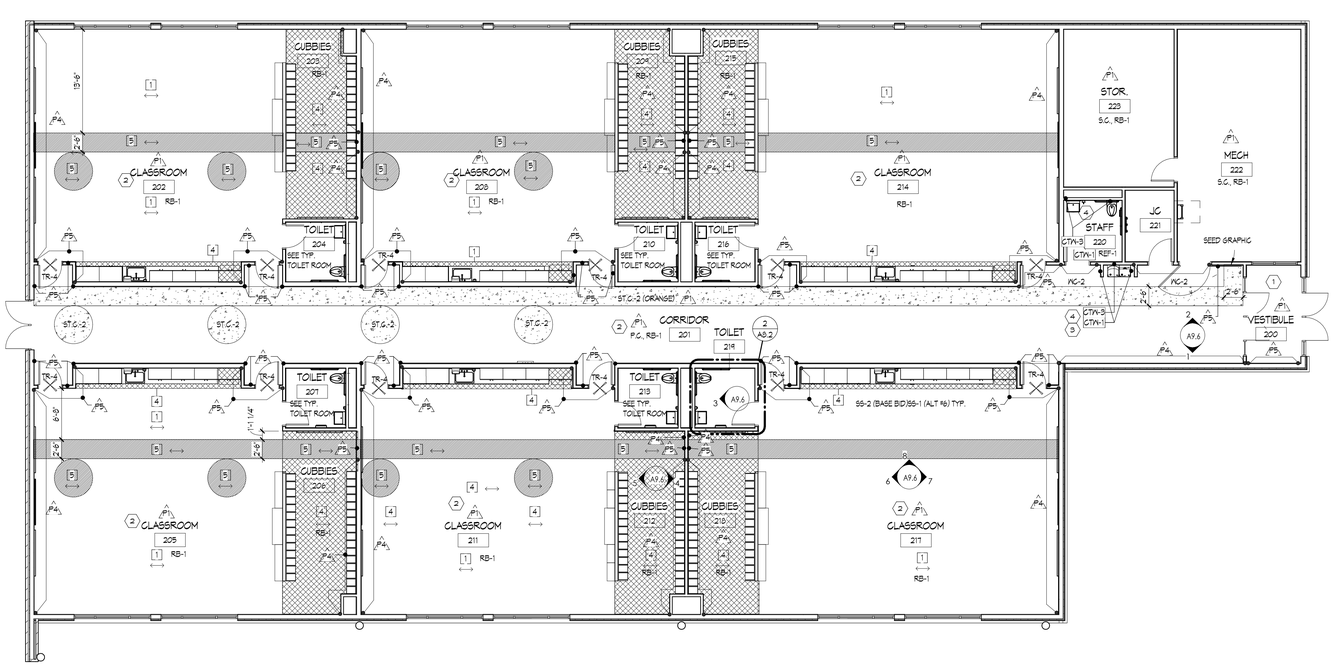
A	PAINT, SEE SPECIFICATION SECTIONS 099123 & 099600
E	MATCH EXISTING ADJ. COLOR
#	CERAMIC FLOOR TILE, SEE SPECIFICATION SECTION 093013
#	CERAMIC TILE WALL, SEE SPECIFICATION SECTION 093013
#	RESILIENT ATHLETIC FLOORING, SEE SPECIFICATION SECTION 096566
#	INTEGRAL PIGMENTED CONCRETE FLOORING, SEE SPECIFICATION SECTION 033543
#	LUXURY VINYL TILE, SEE SPECIFICATION SECTION 096514
C.T.	CARPET TILE, SEE SPECIFICATION SECTION 096800
MT	BARRIER FREE METAL TRANSITION EQUAL TO SCHLUTER RENO-RAMP
P.C.	POLISHED CONCETE FLOOR, (SALT & PEPPER)
RB-#	RUBBER BASE, SEE SPECIFICATION SECTION 096513
REF-#	RESINOUS EPOXY FLOORING
RT	RESILIENT TRANSITION, SEE SPECIFICATION SECTION 096513
S.C.	SEALED CONCRETE FLOOR
ST.C.	STAINED CONCRETE FLOOR
℄	CONTROL JOINT
	PRODUCT EXTENTS WITH MATERIAL INDICATED
WP	WORK POINT
	FLOORING TRANSITION
⟷	MATERIAL INSTALL DIRECTION
A | B	CHANGE OF MATERIAL

COLOR LAYOUT PLAN KEYNOTES

1. WALKOFF CPT WITH RB-1.
2. ALUMINUM CORNER GUARD, 5'-0" H - MOUNT 4'A.F.F.
3. METAL TRIM AT EXPOSED CORNERS OF WALL TILE.
4. FULL HEIGHT WALL TILE
5. PROVIDE CLEAN FLOORING TRANSITION BETWEEN EPOXY FLOOR AND POLISHED CONCRETE



2 TYP. TOILET RM FINISH PLAN-UNIT 200
1/4" = 1'-0"



1 COLOR LAYOUT PLAN - UNIT 200
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
COLOR LAYOUT PLAN - UNIT 200

SHEET NO.
A8.2

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LAST PLOTTED: 2023-12-15 3:16:19 PM
C:\Users\mcgillis\Documents\Revit\Willow_Willow_Revit_v24_2023_mcgillis.rvt

COLOR LAYOUT PLAN GENERAL NOTES

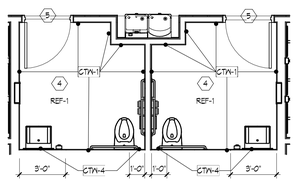
1. SEE REFLECTED CEILING PLANS FOR ACOUSTICAL CEILING TYPES.
2. UNLESS NOTED OTHERWISE, PAINT NEW BULKHEADS, GYP CEILINGS, AND EXPOSED CEILINGS IN COLORS INDICATED ON THE REFLECTED CEILING PLANS AND COLOR LAYOUT PLANS.
3. AT EXPOSED SEALED CONCRETE, PROVIDE HEAVY DUTY SEMI-RIGID EPOXY JOINT FILLER. CONTROL JOINTS AT POLISHED CONCRETE 10' X 10' OR AS NOTED ON COLOR PLANS.
4. FLOORING TRANSITIONS TO OCCUR IN LINE WITH THE CENTERLINE OF THE DOOR LEAF. PROVIDE A CLEAN TRANSITION BETWEEN POLISHED AND SEALED CONCRETE FLOORS.
5. PAINT EXPOSED DOMESTIC WATER PIPING P-1 U.N.O.
6. PAINT EXPOSED FIRE SUPPRESSION LINE PIPING P-5 U.N.O.
7. PAINT EXPOSED GEOTHERMAL LINE PIPING P-3 U.N.O.
8. PAINT EXPOSED ELECTRICAL CONDUIT P-4 U.N.O.
9. AT EXPOSED CEILING, PAINT STRUCTRUAL ELEMENTS TO MATCH COLOR INDICATED.
10. VERIFY LETTERING FONT AND SIZES WITH OWNER IN FIELD.
11. ALL WINDOW SILLS TO RECEIVE WHITE SOLID SURFACE U.N.O.
12. PAINT ALL HM FRAMES AND DOORS P-8 U.N.O.
13. ALL RESINOUS EPOXY FLOORS TO HAVE INTEGREL RESINOUS EPOXY BASE U.N.O.

COLOR LAYOUT PLAN LEGEND

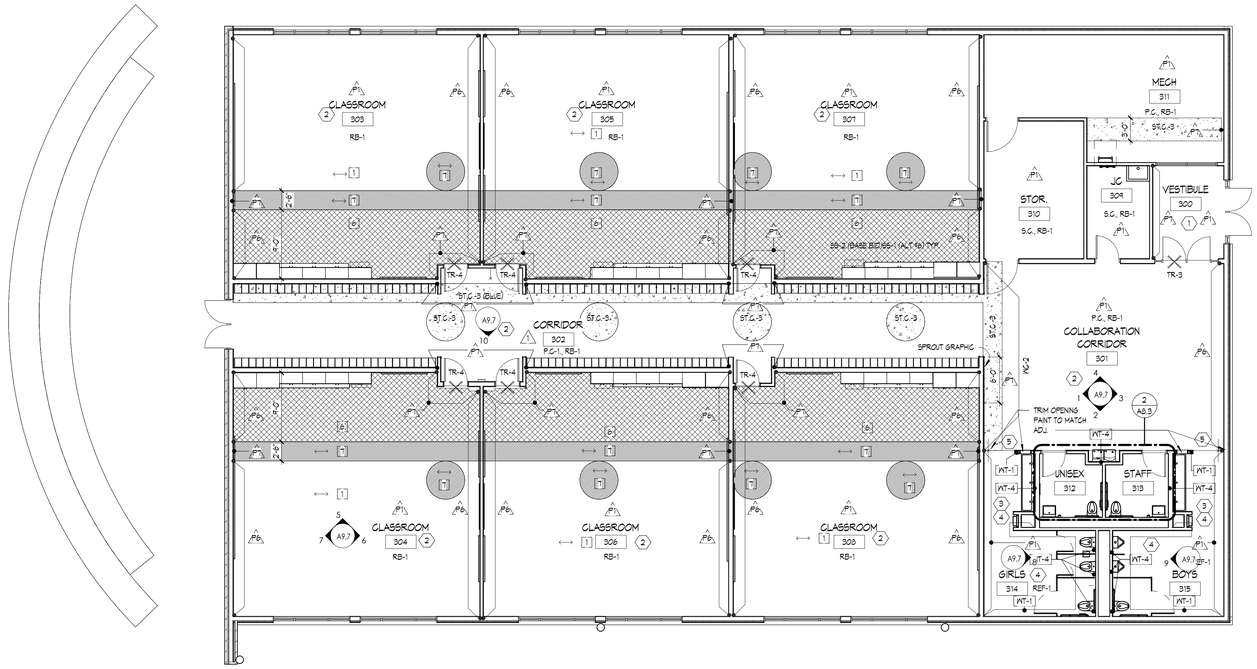
A	PAINT, SEE SPECIFICATION SECTIONS 099123 & 099600
B	MATCH EXISTING ADJ. COLOR
8	CERAMIC FLOOR TILE, SEE SPECIFICATION SECTION 093013
8	CERAMIC TILE WALL, SEE SPECIFICATION SECTION 093013
6	RESILIENT ATHLETIC FLOORING, SEE SPECIFICATION SECTION 096566
8	INTEGRAL PIGMENTED CONCRETE FLOORING, SEE SPECIFICATION SECTION 033543
8	LUXURY VINYL TILE, SEE SPECIFICATION SECTION 096514
C.T.	CARPET TILE, SEE SPECIFICATION SECTION 096800
MT	BARRIER FREE METAL TRANSITION EQUAL TO SCHLUTER RENO-RAMP
P.C.	POLISHED CONCETE FLOOR, (SALT & PEPPER)
RB-#	RUBBER BASE, SEE SPECIFICATION SECTION 096513
REF-#	RESINOUS EPOXY FLOORING
RT	RESILIENT TRANSITION, SEE SPECIFICATION SECTION 096513
S.C.	SEALED CONCRETE FLOOR
ST.C.	STAINED CONCRETE FLOOR
℄	CONTROL JOINT
	PRODUCT EXTENTS WITH MATERIAL INDICATED
WP	WORK POINT
	FLOORING TRANSITION
⟷	MATERIAL INSTALL DIRECTION
A B.	CHANGE OF MATERIAL

COLOR LAYOUT PLAN KEYNOTES

1. WALKOFF CPT WITH RB-1.
2. ALUMINUM CORNER GUARD, 5'-0" H - MOUNT 4'A.F.F.
3. METAL TRIM AT EXPOSED CORNERS OF WALL TILE.
4. FULL HEIGHT WALL TILE
5. PROVIDE CLEAN FLOORING TRANSITION BETWEEN EPOXY FLOOR AND POLISHED CONCRETE



2 TYP. TOILET ROOM-UNIT 300
1/4" = 1'-0"



1 COLOR LAYOUT PLAN - UNIT 300
1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

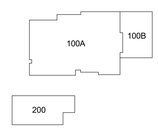
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
COLOR LAYOUT PLAN - UNIT 300

SHEET NO.
A8.3

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C:\Users\mgrimm\Documents\Revit Files\willow_Willow_Arch_Acad_2022_mgrimm.rvt

COLOR LAYOUT PLAN GENERAL NOTES

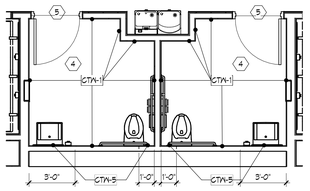
1. SEE REFLECTED CEILING PLANS FOR ACOUSTICAL CEILING TYPES.
2. UNLESS NOTED OTHERWISE, PAINT NEW BULKHEADS, GYP CEILINGS, AND EXPOSED CEILINGS IN COLORS INDICATED ON THE REFLECTED CEILING PLANS AND COLOR LAYOUT PLANS.
3. AT EXPOSED SEALED CONCRETE, PROVIDE HEAVY DUTY SEMI-RIGID EPOXY JOINT FILLER. CONTROL JOINTS AT POLISHED CONCRETE 10' X 10' OR AS NOTED ON COLOR PLANS.
4. FLOORING TRANSITIONS TO OCCUR IN LINE WITH THE CENTERLINE OF THE DOOR LEAF. PROVIDE A CLEAN TRANSITION BETWEEN POLISHED AND SEALED CONCRETE FLOORS.
5. PAINT EXPOSED DOMESTIC WATER PIPING P-1 U.N.O.
6. PAINT EXPOSED FIRE SUPPRESSION LINE PIPING P-5 U.N.O.
7. PAINT EXPOSED GEOTHERMAL LINE PIPING P-3 U.N.O.
8. PAINT EXPOSED ELECTRICAL CONDUIT P-9 U.N.O.
9. AT EXPOSED CEILING, PAINT STRUCTRUAL ELEMENTS TO MATCH COLOR INDICATED.
10. VERIFY LETTERING FONT AND SIZES WITH OWNER IN FIELD.
11. ALL WINDOW SILLS TO RECEIVE WHITE SOLID SURFACE U.N.O.
12. PAINT ALL HM FRAMES AND DOORS P-5 U.N.O.
13. ALL RESINOUS EPOXY FLOORS TO HAVE INTEGREL RESINOUS EPOXY BASE U.N.O.

COLOR LAYOUT PLAN LEGEND

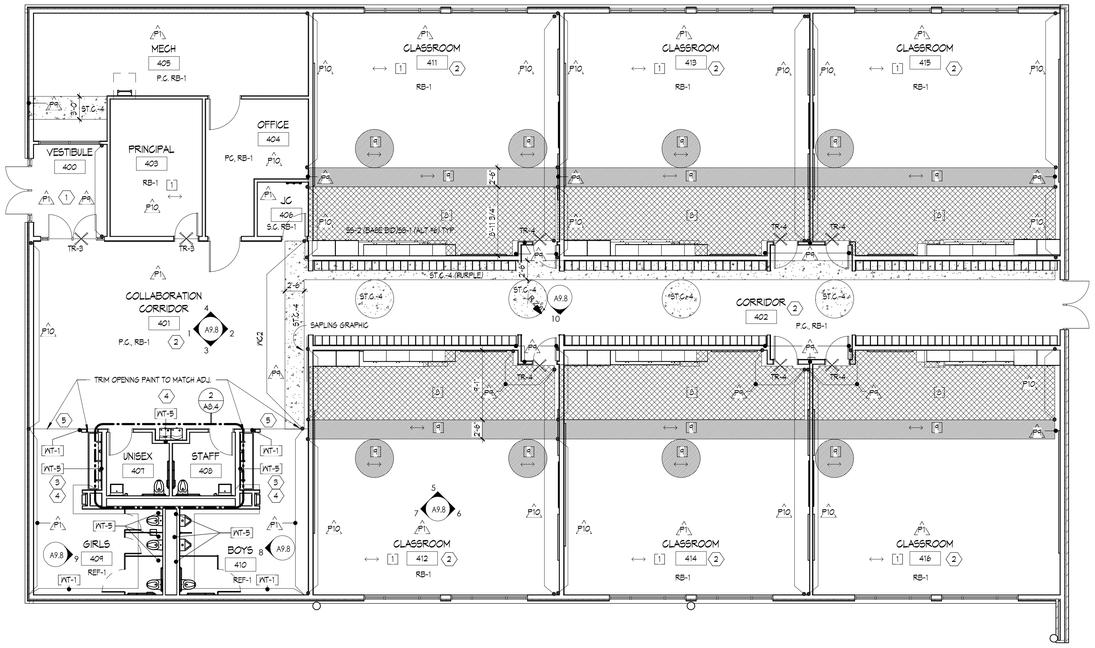
A	PAINT, SEE SPECIFICATION SECTIONS 099123 & 099600
E	MATCH EXISTING ADJ. COLOR
F	CERAMIC FLOOR TILE, SEE SPECIFICATION SECTION 093013
G	CERAMIC TILE WALL, SEE SPECIFICATION SECTION 093013
H	RESILIENT ATHLETIC FLOORING, SEE SPECIFICATION SECTION 096566
P	INTEGRAL PIGMENTED CONCRETE FLOORING, SEE SPECIFICATION SECTION 033543
R	LUXURY VINYL TILE, SEE SPECIFICATION SECTION 096519
C.T.	CARPET TILE, SEE SPECIFICATION SECTION 096800
MT	BARRIER FREE METAL TRANSITION EQUAL TO SCHLUTER RENO-RAMP
P.C.	POLISHED CONCETE FLOOR, (SALT & PEPPER)
RB-#	RUBBER BASE, SEE SPECIFICATION SECTION 096513
REF-#	RESINOUS EPOXY FLOORING
RT	RESILIENT TRANSITION, SEE SPECIFICATION SECTION 096513
S.C.	SEALED CONCRETE FLOOR
ST.C.	STAINED CONCRETE FLOOR
℄	CONTROL JOINT
	PRODUCT EXTENTS WITH MATERIAL INDICATED
WP	WORK POINT
	FLOORING TRANSITION
⟷	MATERIAL INSTALL DIRECTION
A | B	CHANGE OF MATERIAL

COLOR LAYOUT PLAN KEYNOTES

1. WALKOFF CPT WITH RB-1.
2. ALUMINUM CORNER GUARD, 5'-0" H - MOUNT 4"A.F.F.
3. METAL TRIM AT EXPOSED CORNERS OF WALL TILE.
4. FULL HEIGHT WALL TILE
5. PROVIDE CLEAN FLOORING TRANSITION BETWEEN EPOXY FLOOR AND POLISHED CONCRETE



2 TYP. TOILET RM.-UNIT 400
1/4" = 1'-0"



1 FIRST FLOOR COLOR LAYOUT PLAN - UNIT 400
1/8" = 1'-0"

KINGSCOTT
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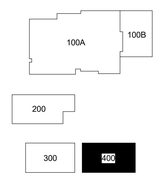
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
COLOR LAYOUT PLAN - UNIT 400

SHEET NO.
A8.4

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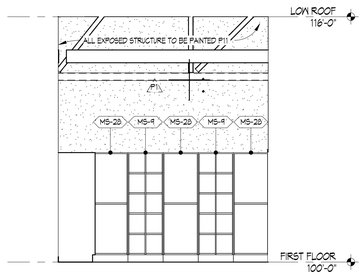
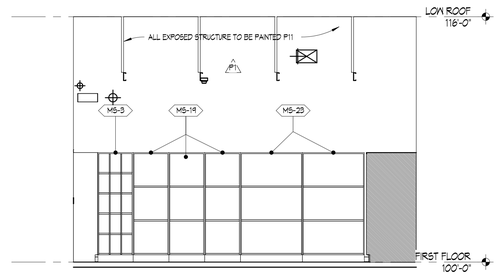
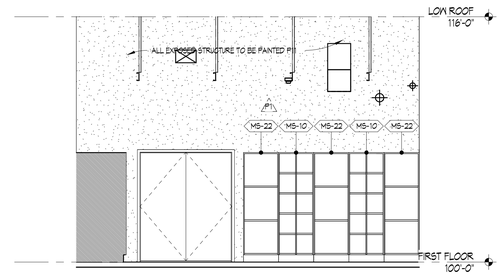


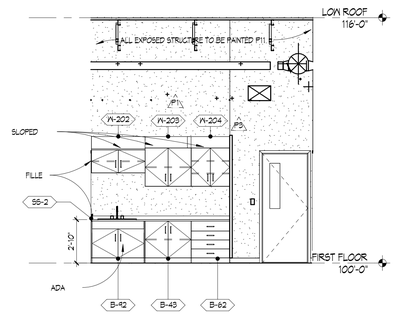
10 BAND STORAGE- EAST ELEVATION
1/4" = 1'-0"



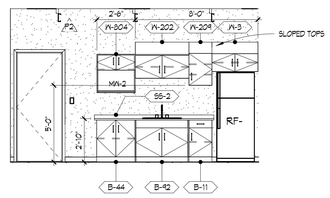
9 BAND STORAGE-NORTH ELEVATION
1/4" = 1'-0"



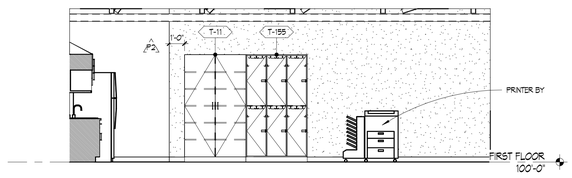
8 BAND STORAGE-SOUTH ELEVATION
1/4" = 1'-0"



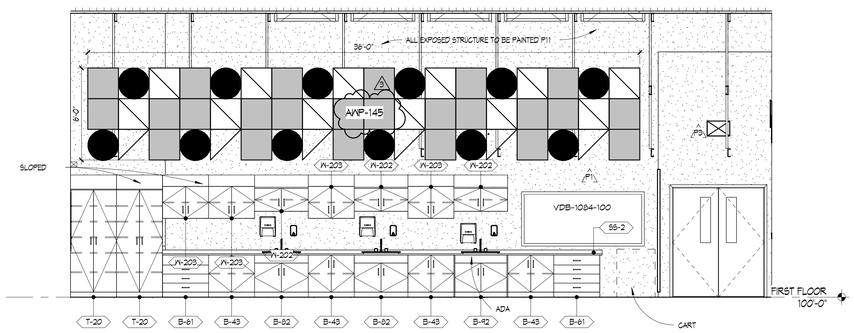
7 RESOURCE RM.-ELEVATION
1/4" = 1'-0"



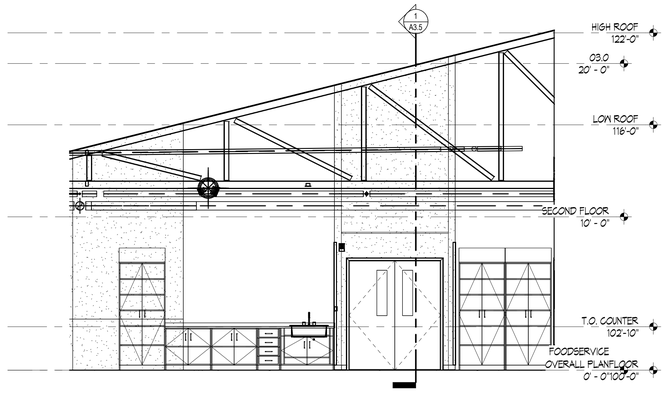
6 TEACHERS LOUNGE-ELEVATION
1/4" = 1'-0"



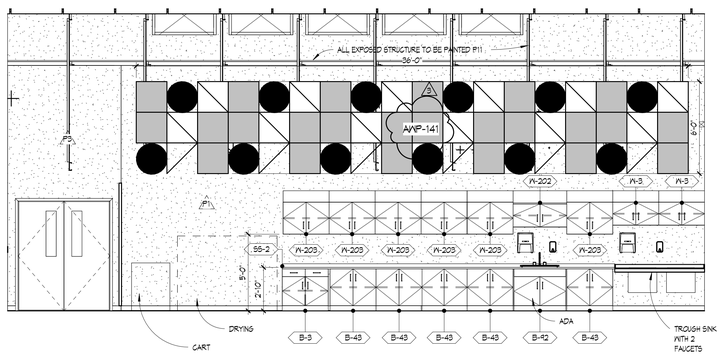
5 TEACHER LOUNGE-ELEVATION 2
1/4" = 1'-0"



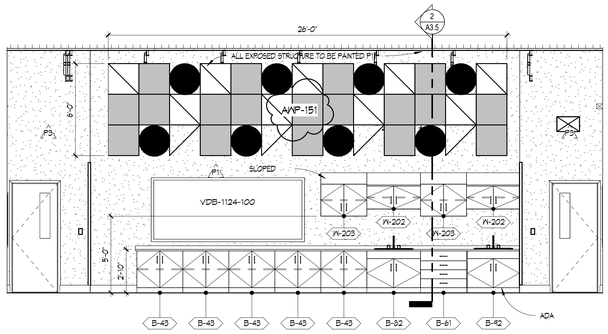
4 CLASSROOM- ELEVATION
1/4" = 1'-0"



3 MUSIC RM-CASEWORK ELEVATION1
1/4" = 1'-0"



2 ART RM-ELEVATION
1/4" = 1'-0"



1 STEM/COMM. -ELEVATION
1/4" = 1'-0"

KINGSCOTT
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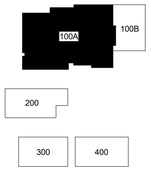
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A9.1

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

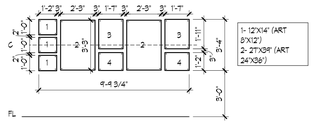
Willow School

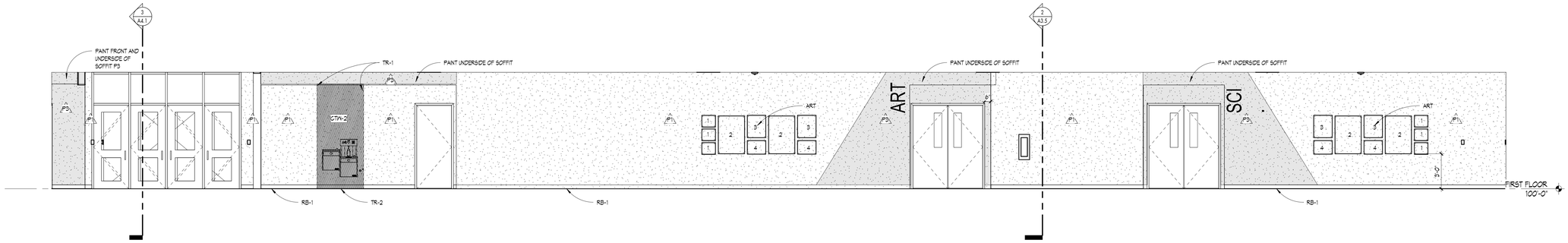
Lansing School District

1012 W. Willow
Lansing, MI 48915

ART DISPLAY-UNIT 100

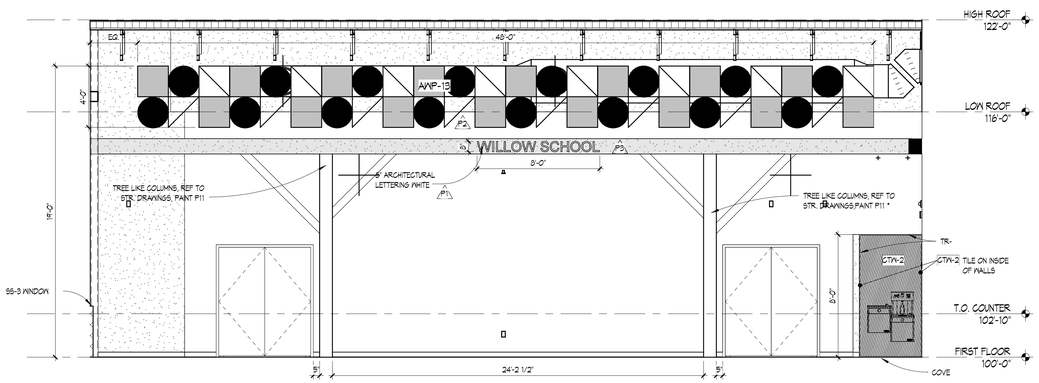
CLEAR ACRYLIC STAND OFF ART FRAMES (SILVER





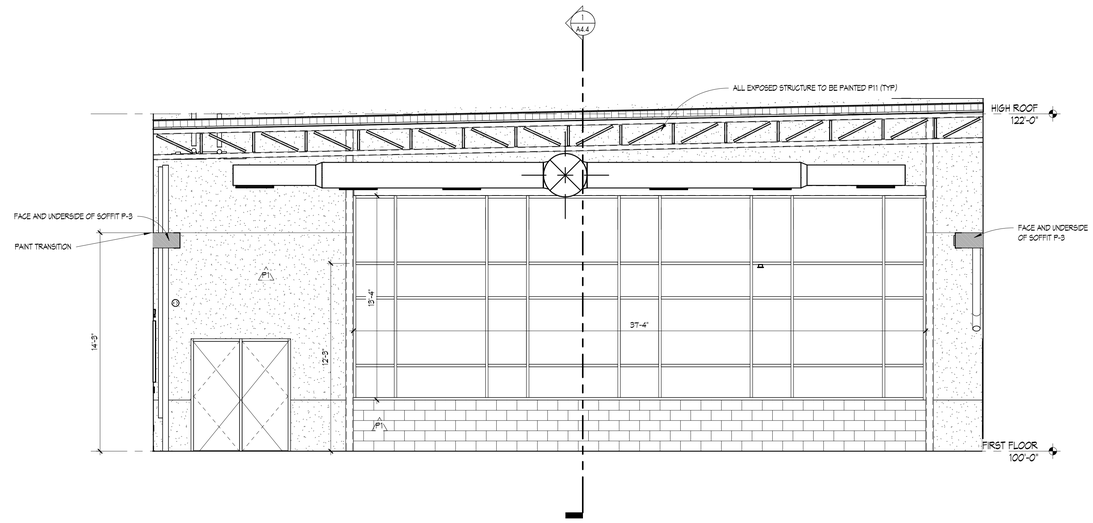
5 CORIDOOR- CLASSROOM ENTRY

1/4" = 1'-0"



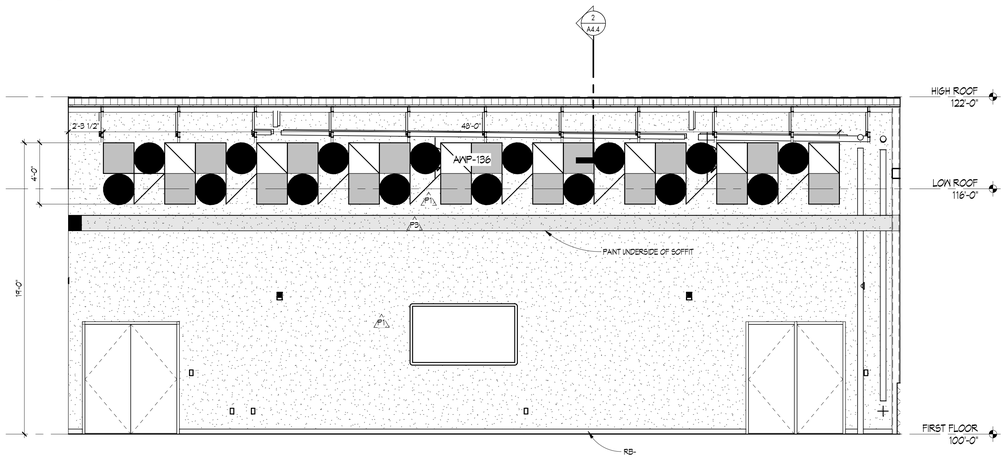
4 CAFETERIA-WEST ELEVATION

1/4" = 1'-0"



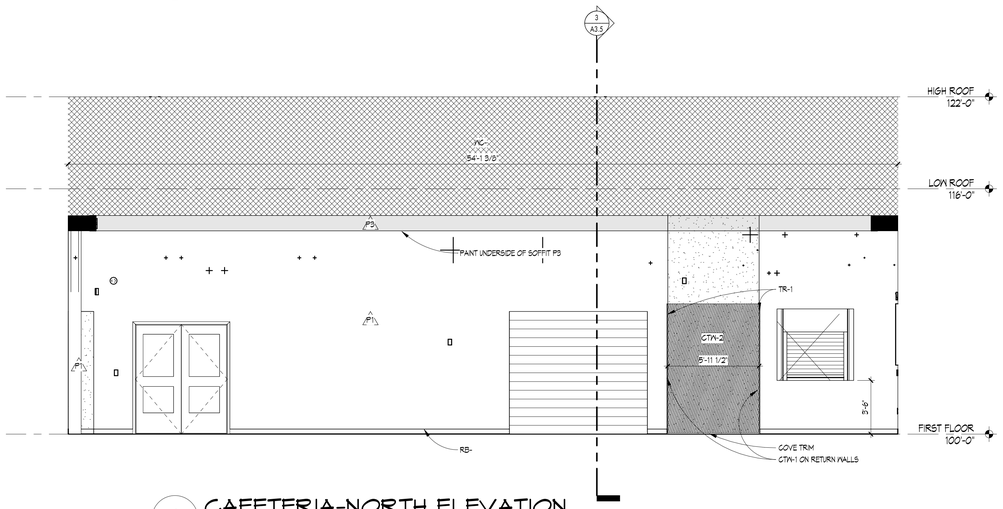
3 CAFETERIA-SOUTH ELEVATION

1/4" = 1'-0"



2 CAFETERIA-EAST ELEVATION

1/4" = 1'-0"

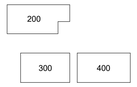


1 CAFETERIA-NORTH ELEVATION

1/4" = 1'-0"

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A9.2

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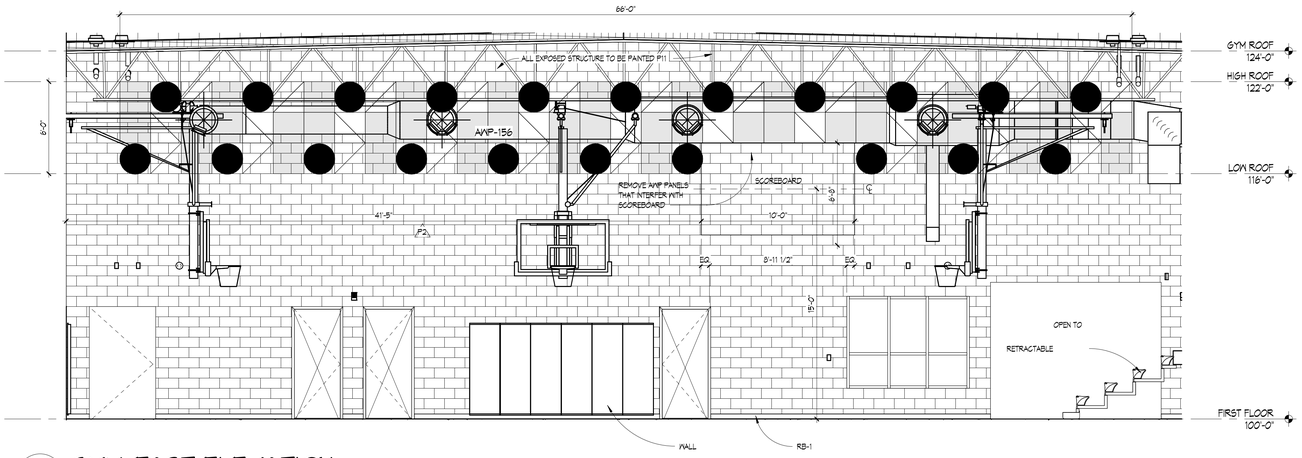
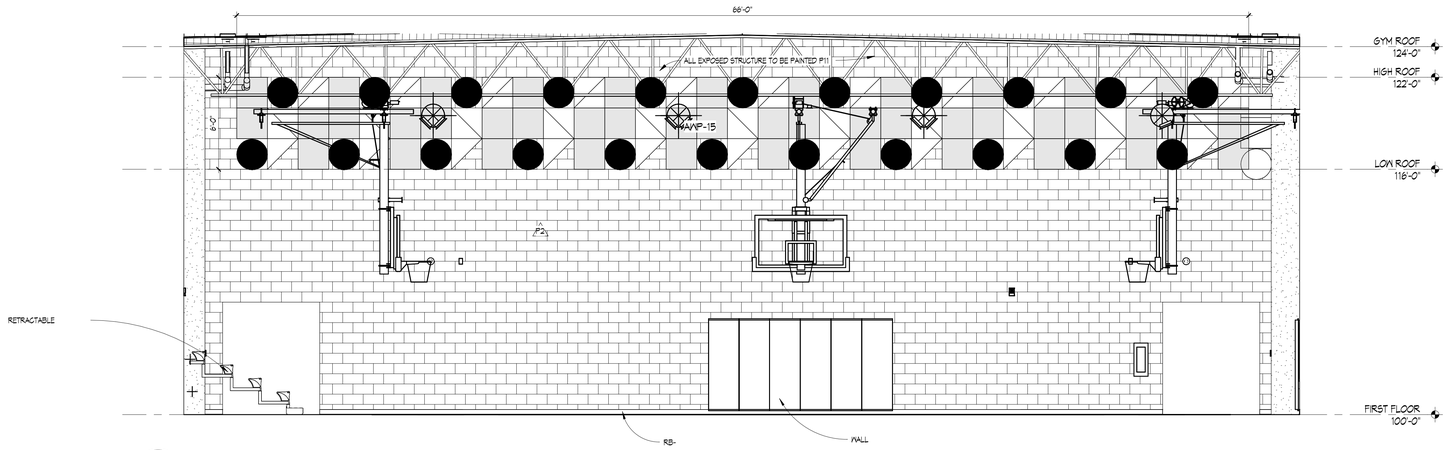
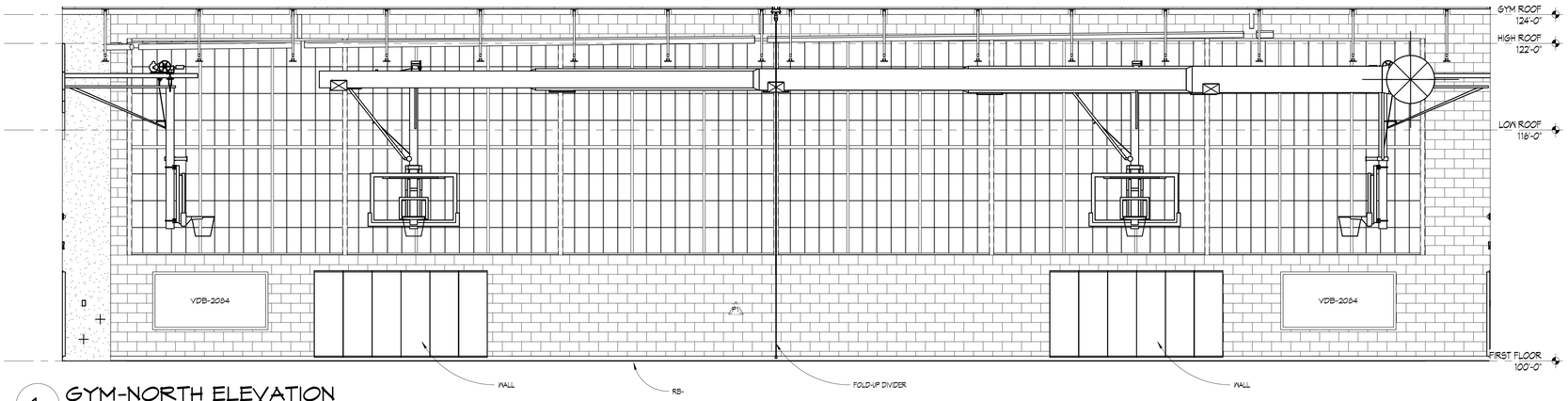


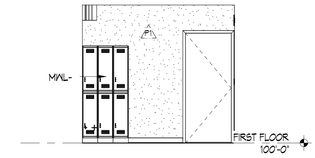
6 GYM-EAST ELEVATION
1/4" = 1'-0"



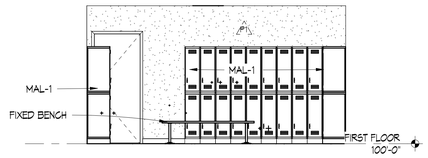
3. GYM-WEST ELEVATION
1/4" = 1'-0"



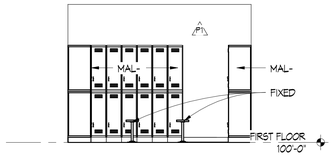
1. GYM-NORTH ELEVATION
1/4" = 1'-0"



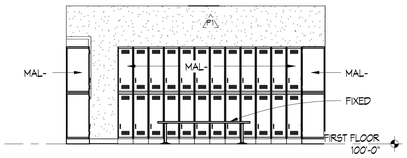
8 SINGLE CHANGING RM
1/4" = 1'-0"



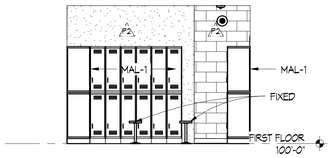
7 CHANGING RM. ELEVATION 4
1/4" = 1'-0"



5 CHANGING RM. ELEVATION 3
1/4" = 1'-0"



4 CHANGING RM ELEVATION 2
1/4" = 1'-0"



2 CHANGING RM. ELEVATION 1
1/4" = 1'-0"

KINGSCOTT
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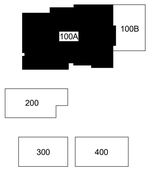
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A9.3

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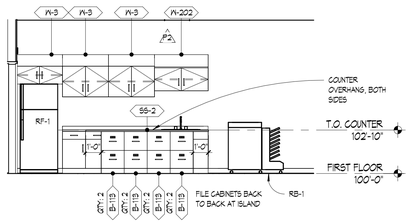
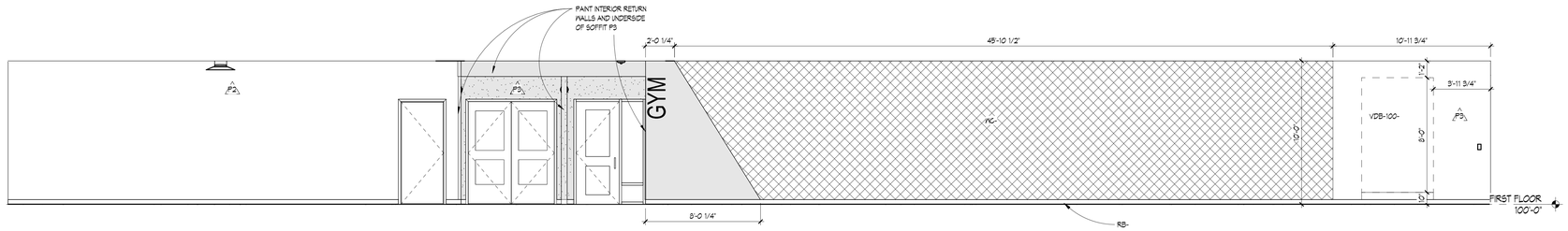
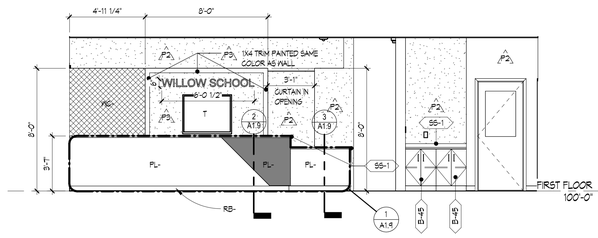


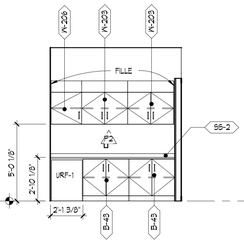
5 OFFICE SUPPORT- ELEVATION
1/4" = 1'-0"



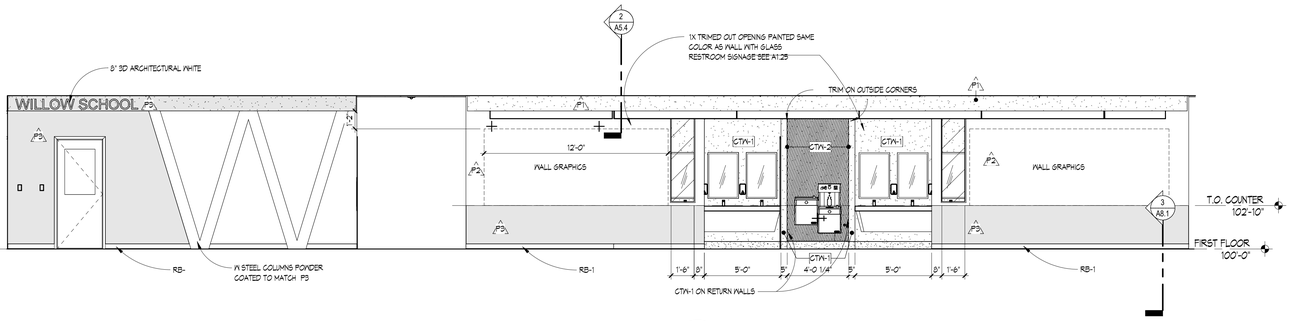
7 CORIDOOR- GYM ENTRY
1/4" = 1'-0"



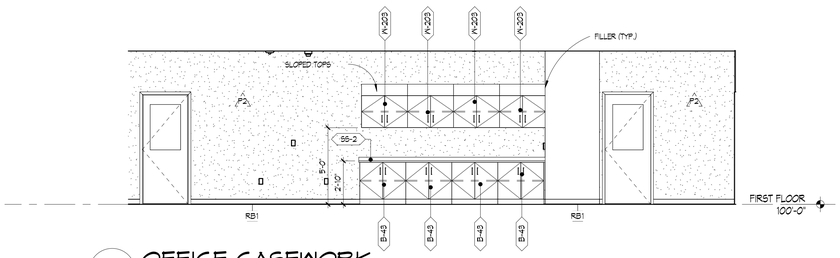
10 FRONT DESK ELEVATION
1/4" = 1'-0"



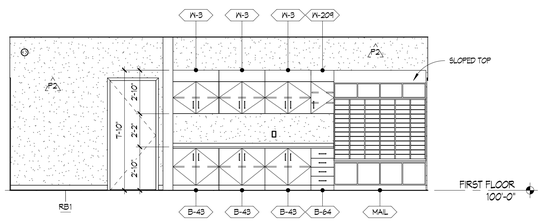
9 CLINIC CASEWORK ELEVATION
1/4" = 1'-0"



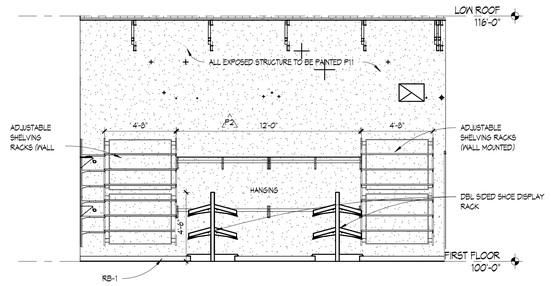
11 CORRIDOR- RESTROOM ENTRY
1/4" = 1'-0"



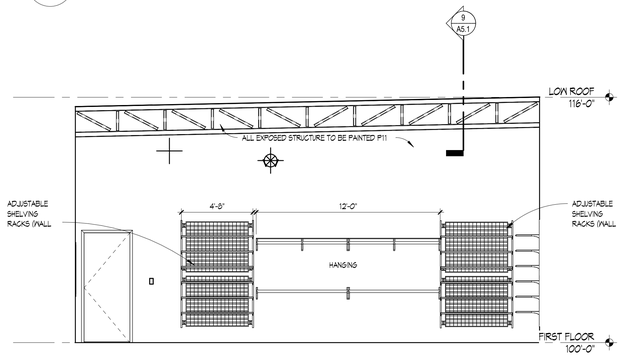
8 OFFICE CASEWORK
1/4" = 1'-0"



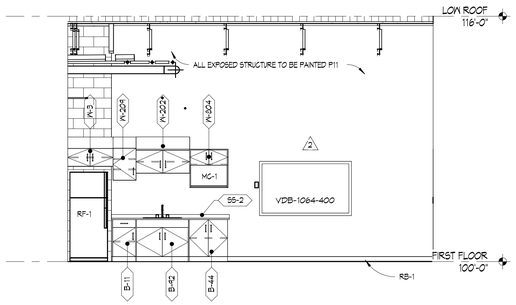
6 OFFICE SUPPORT ELEVATION 2
1/4" = 1'-0"



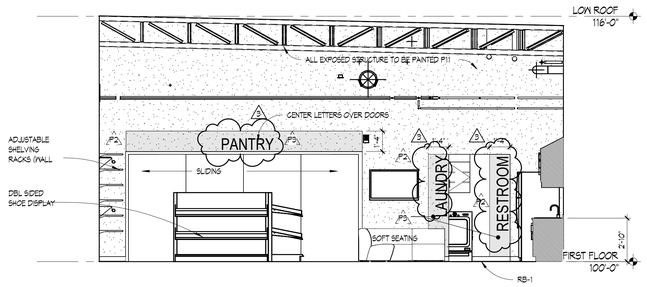
4 FAMILY RM.-SOUTH ELEVATION
1/4" = 1'-0"



3 FAMILY RM.-EAST ELEVATION
1/4" = 1'-0"



2 FAMILY RM- NORTH ELEVATION
1/4" = 1'-0"



1 FAMILY RM. -WEST ELEVATION
1/4" = 1'-0"

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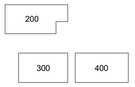
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A9.4

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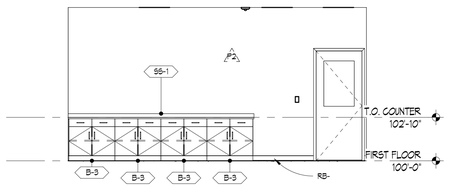
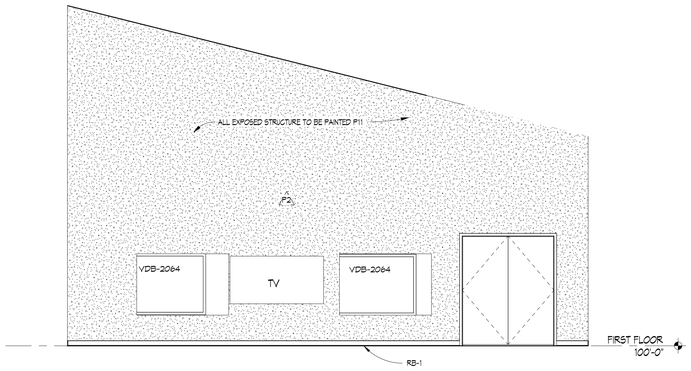
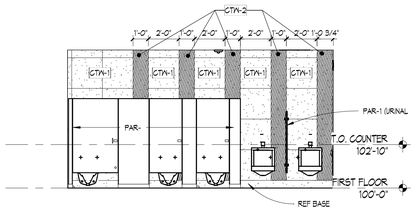


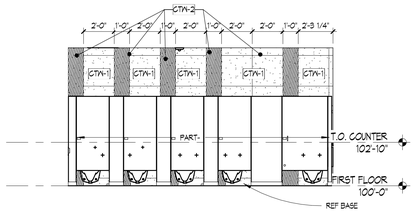
1 CONFERENCE RM ELEVATION
1/4" = 1'-0"



2 MUSIC EAST WALL
1/4" = 1'-0"



3 MEN'S RESTROOM ELEVATION
1/4" = 1'-0"



6 WOMEN'S RESTROOM ELEVATION
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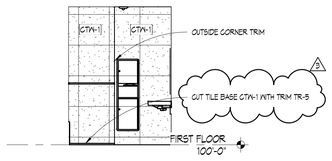
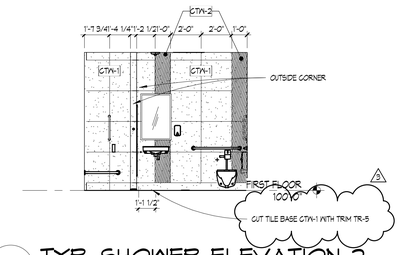
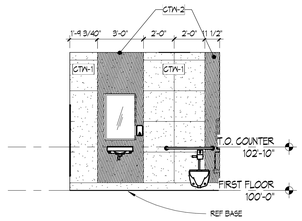


4 TYP. SHOWER ELEVATION
1/4" = 1'-0"



5 TYP. SHOWER ELEVATION 2
1/4" = 1'-0"



7 TYP. SINGLE RESTROOM
1/4" = 1'-0"

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Lansing School District

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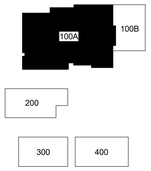
Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024
Addendum 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A9.5

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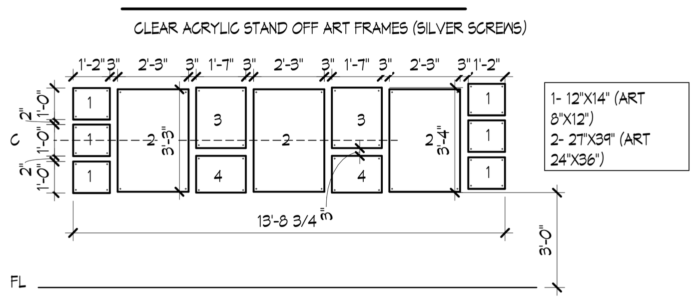
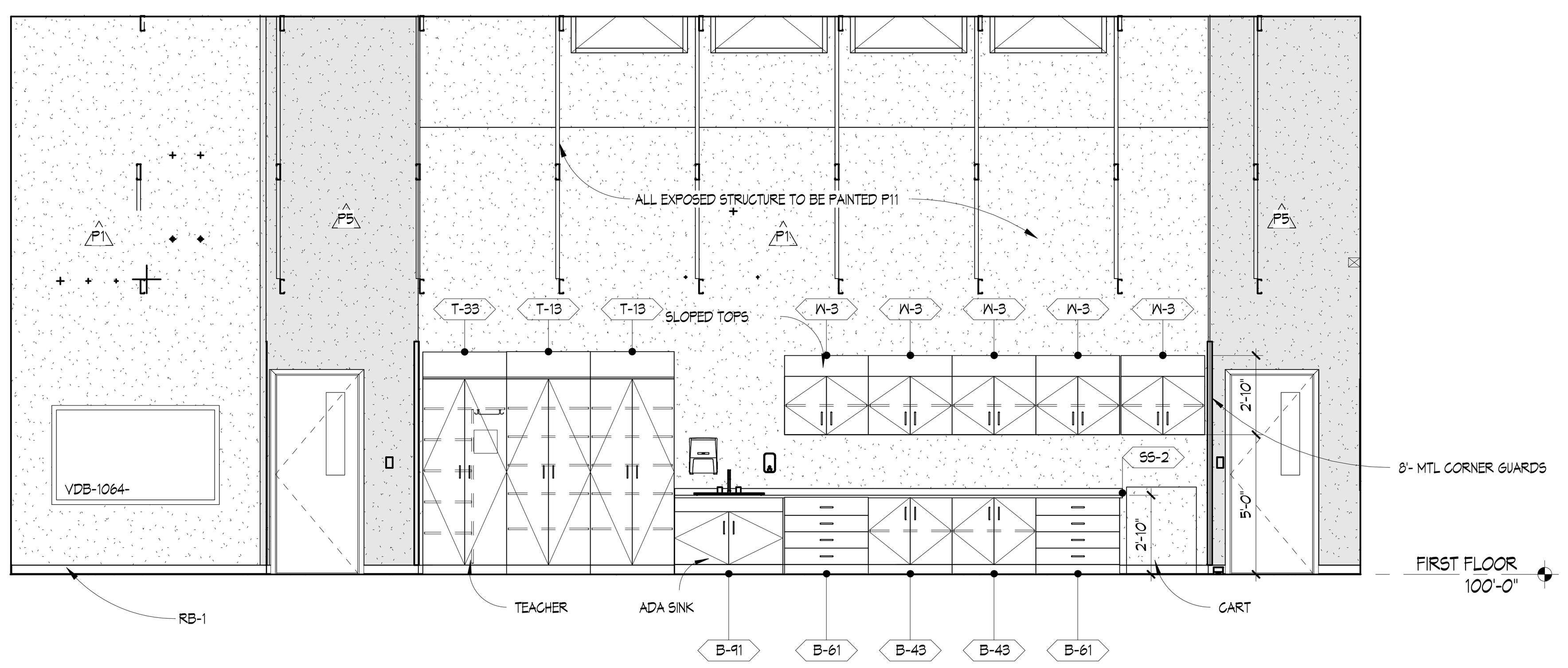
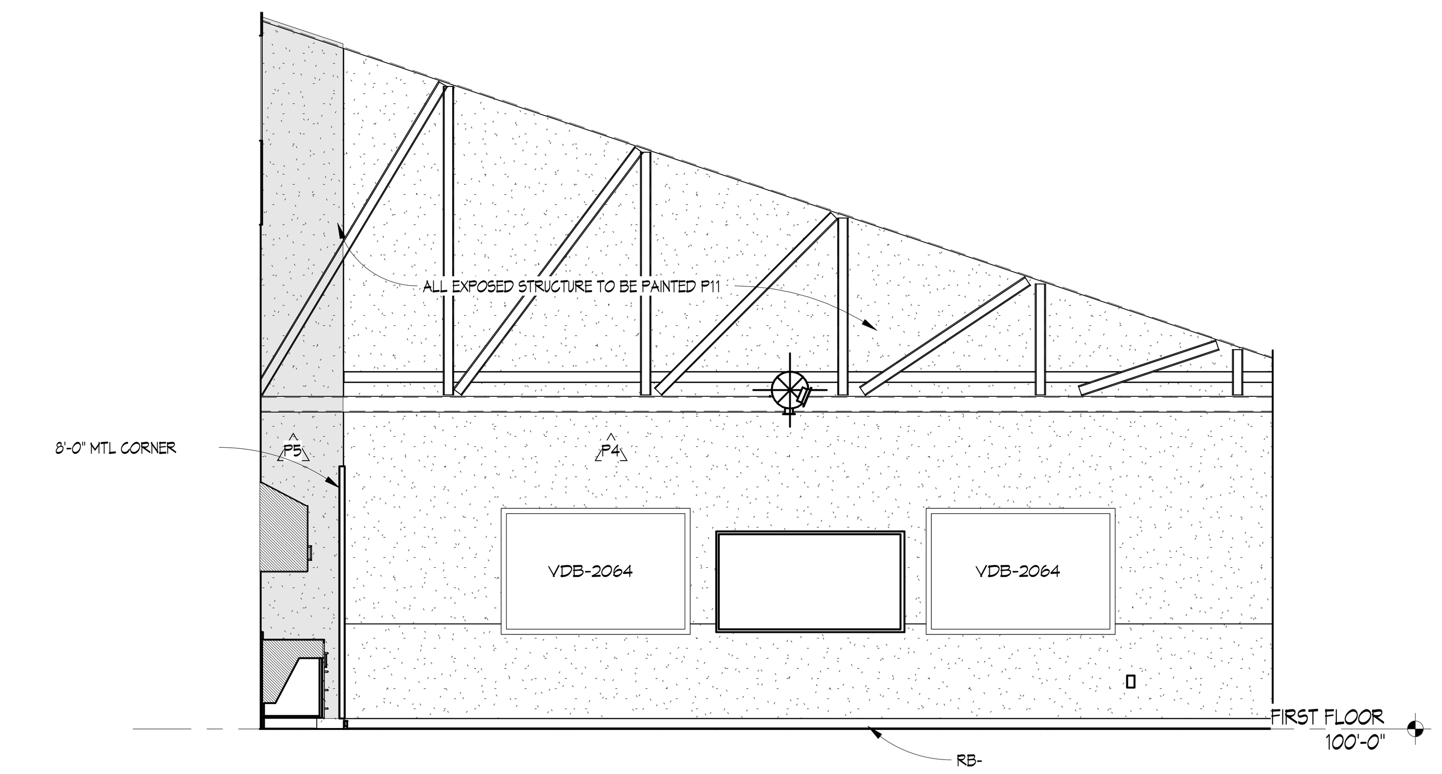
ART DISPLAY-UNIT 200

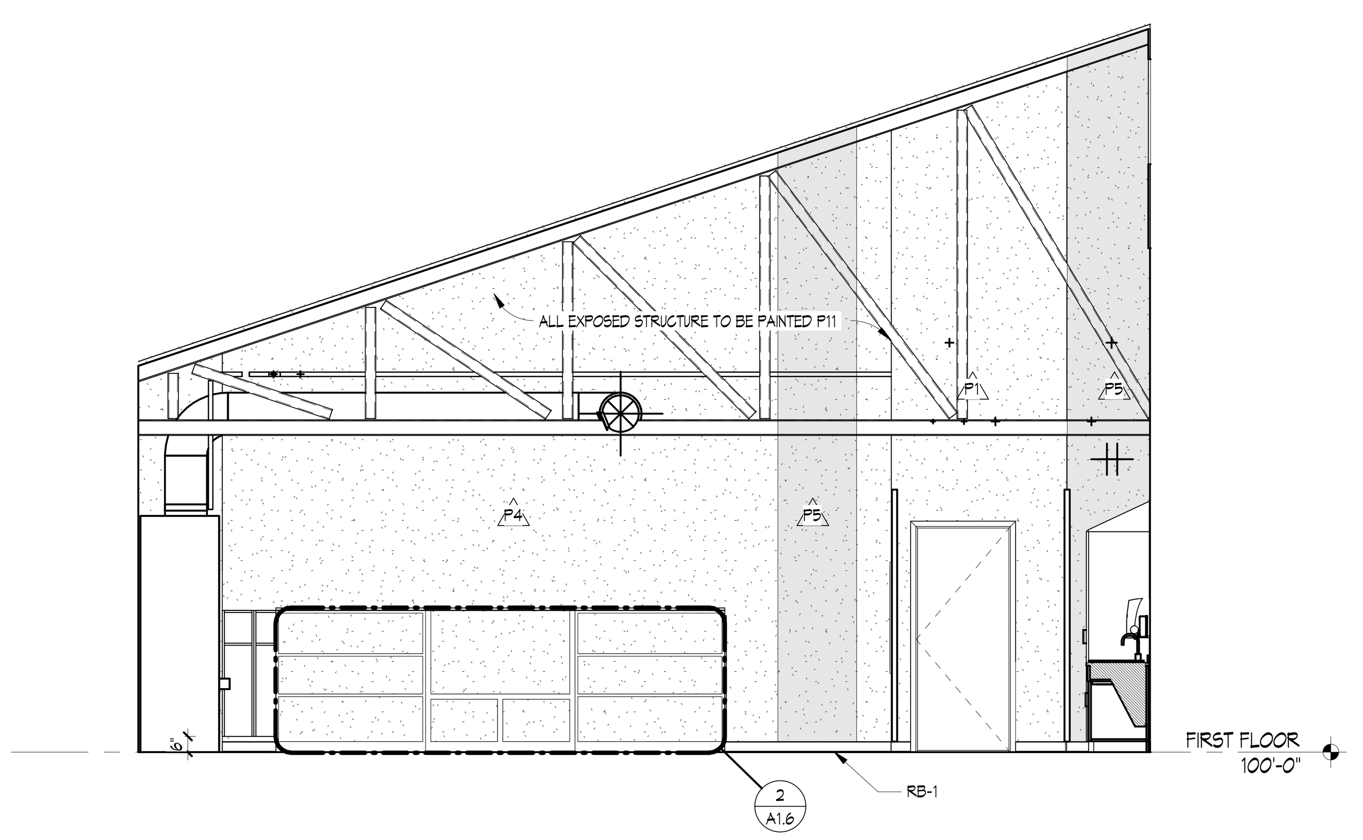




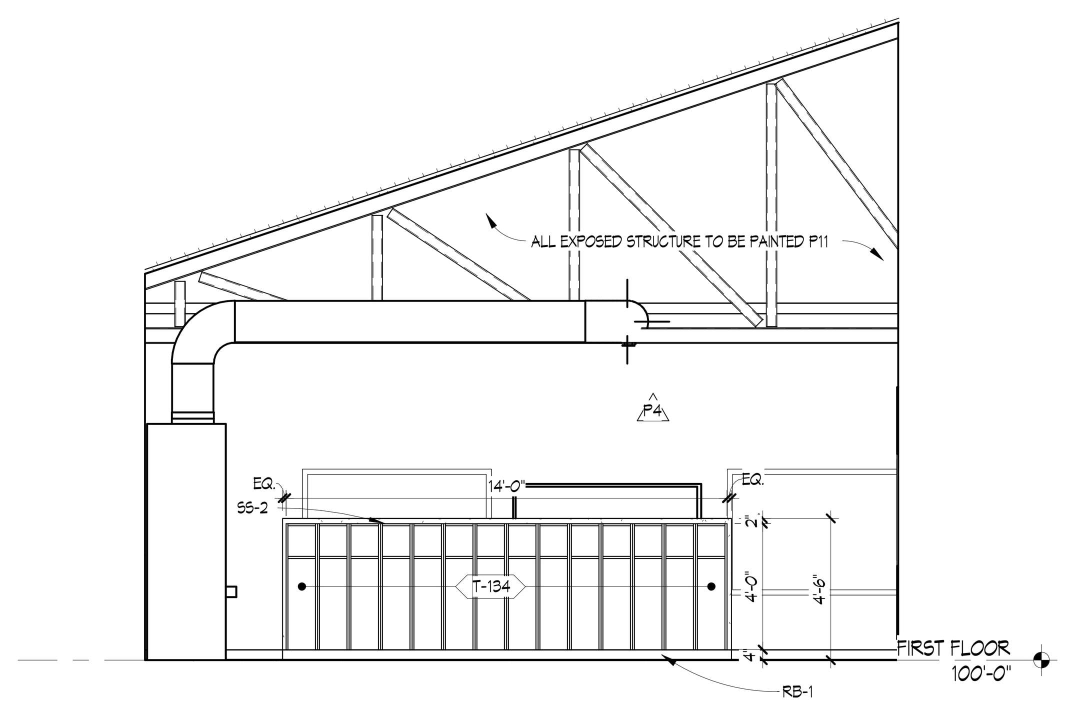
8 CASEWORK (TYP.)-UNIT 200
1/4" = 1'-0"



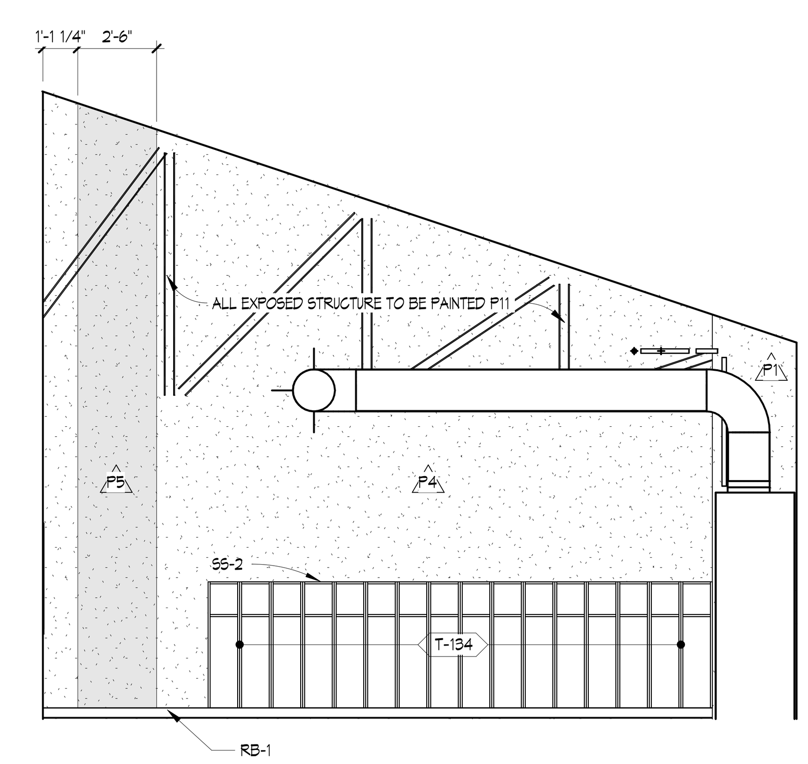
7 TEACHING WALL- UNIT 200
1/4" = 1'-0"



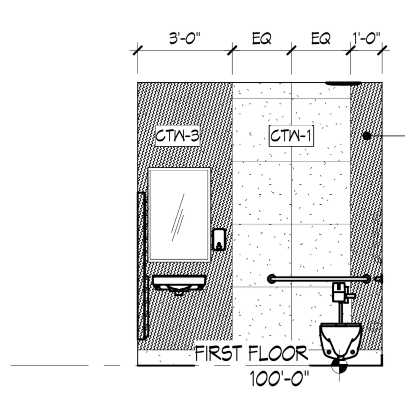
6 NOOK WALL (TYP.)- UNIT 200
1/4" = 1'-0"



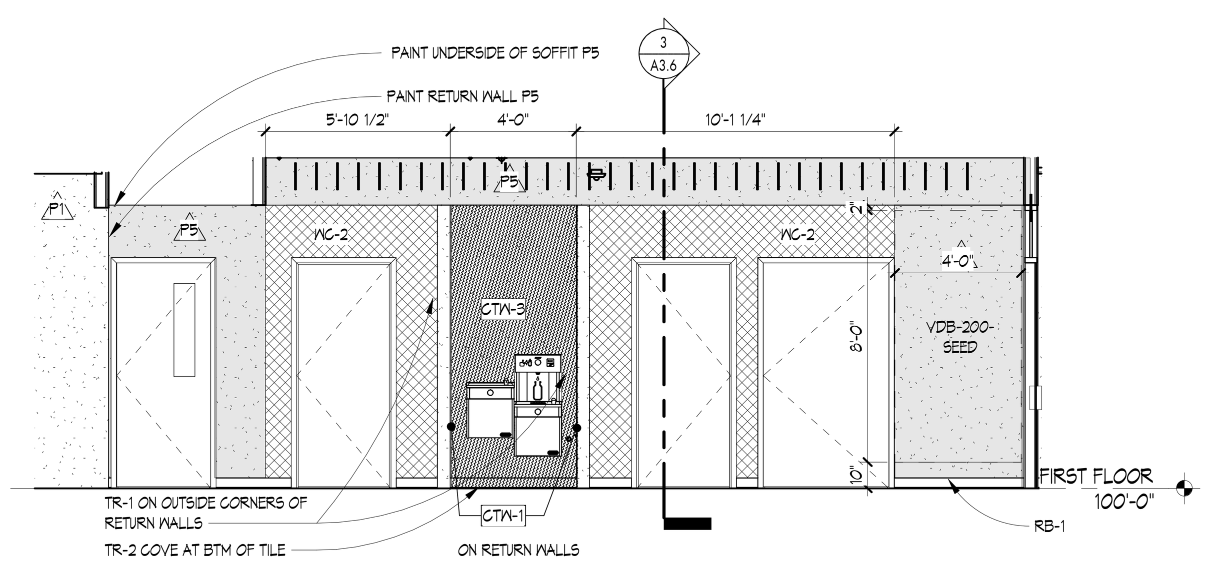
5 TYP. CUBBIES- UNIT 200
1/4" = 1'-0"



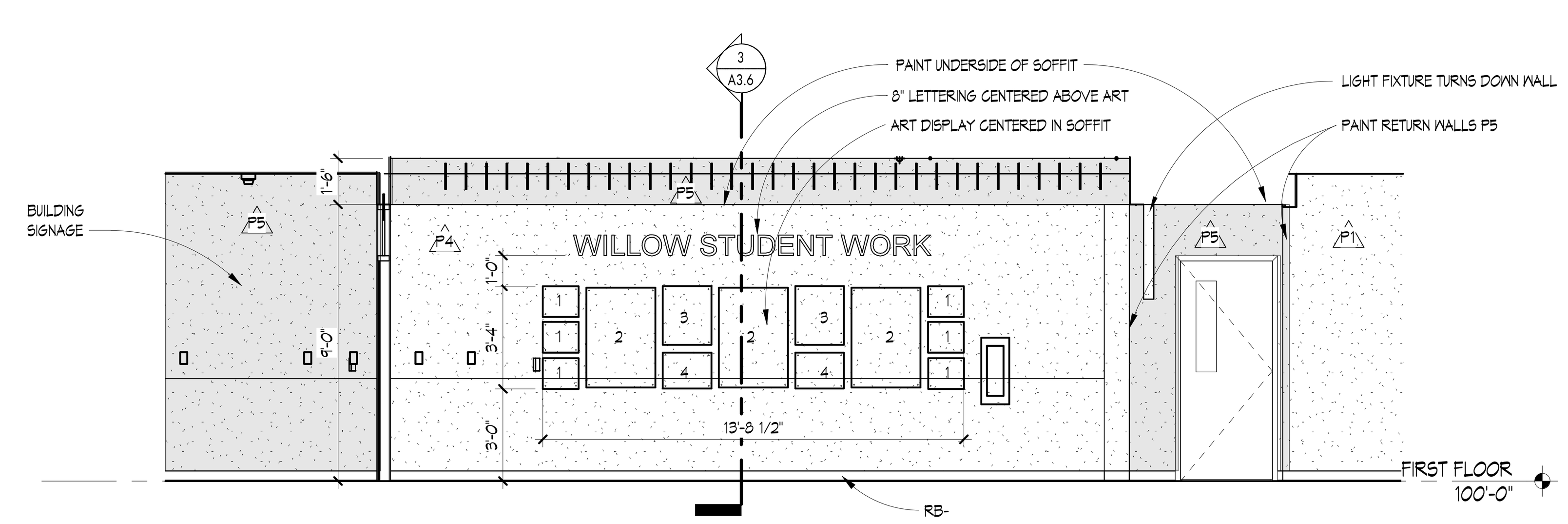
4 TYP. CLASSROOM CUBBIES- UNIT 200
1/4" = 1'-0"



3 TYP. TOILET ROOM
1/4" = 1'-0"



2 CORIDOOR -UNIT 200
1/4" = 1'-0"



1 ART DISPLAY
1/4" = 1'-0"

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1012 W. Willow
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Lansing School District

ISSUANCES	DATE
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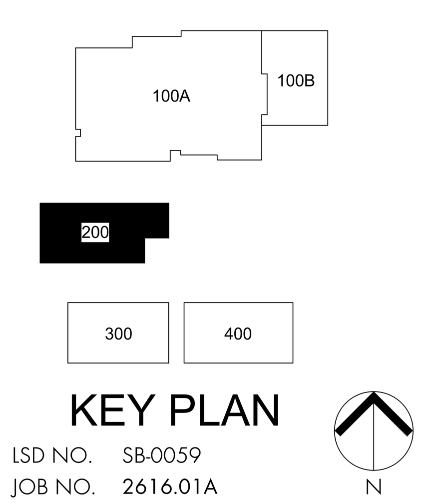

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
INTERIOR ELEVATIONS-UNIT 200

SHEET NO.
A9.6

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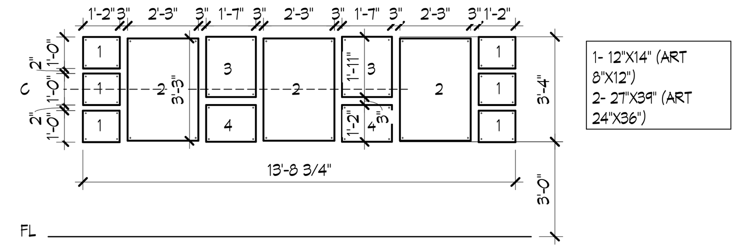
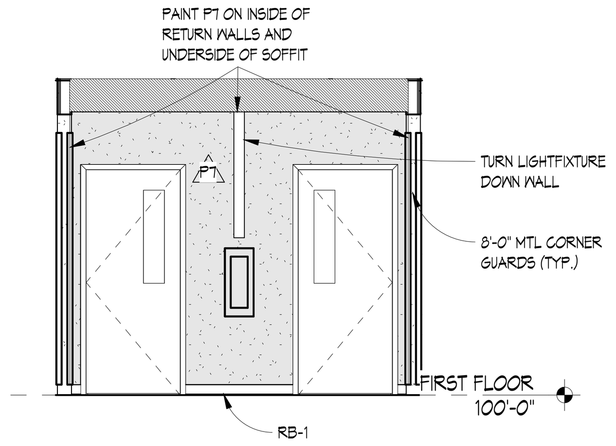
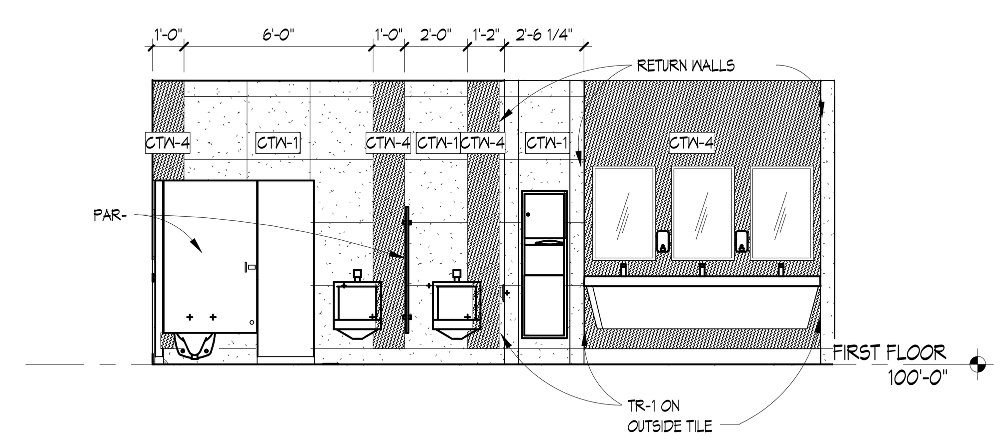
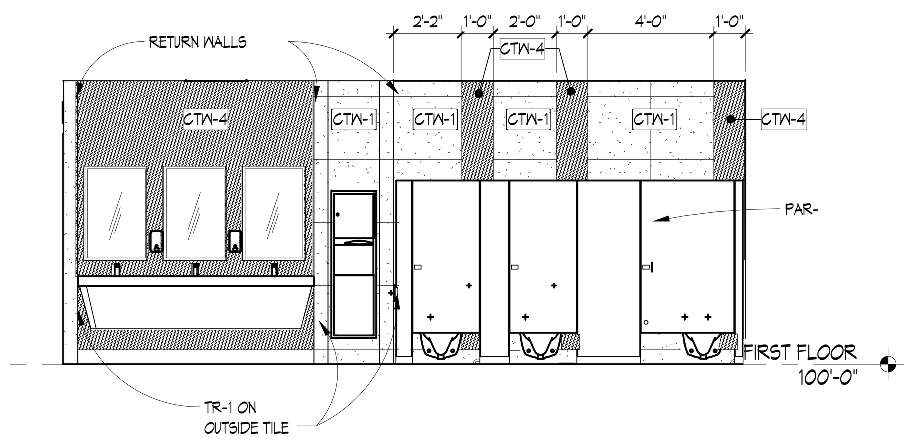




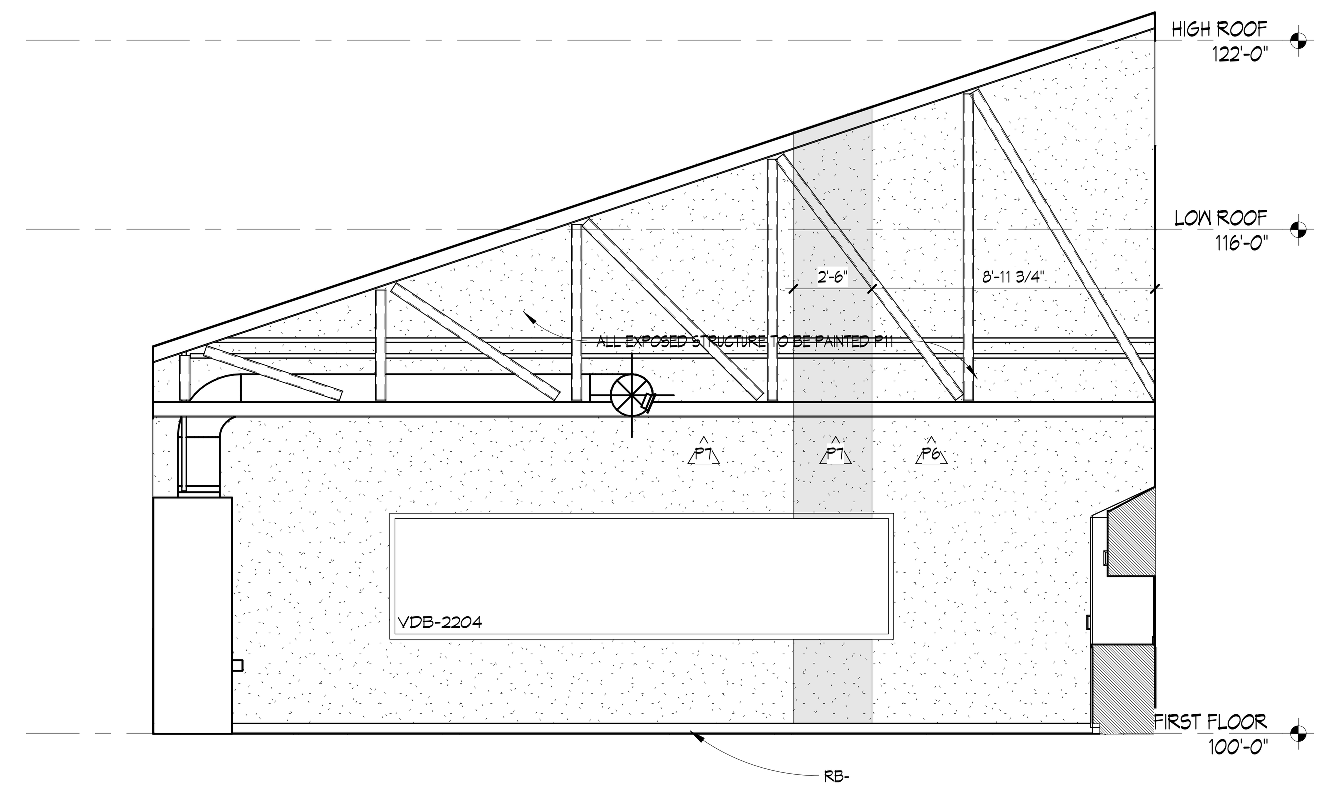
10 CLASSROOM ENTRY (TYP.)-UNIT 300
1/4" = 1'-0"



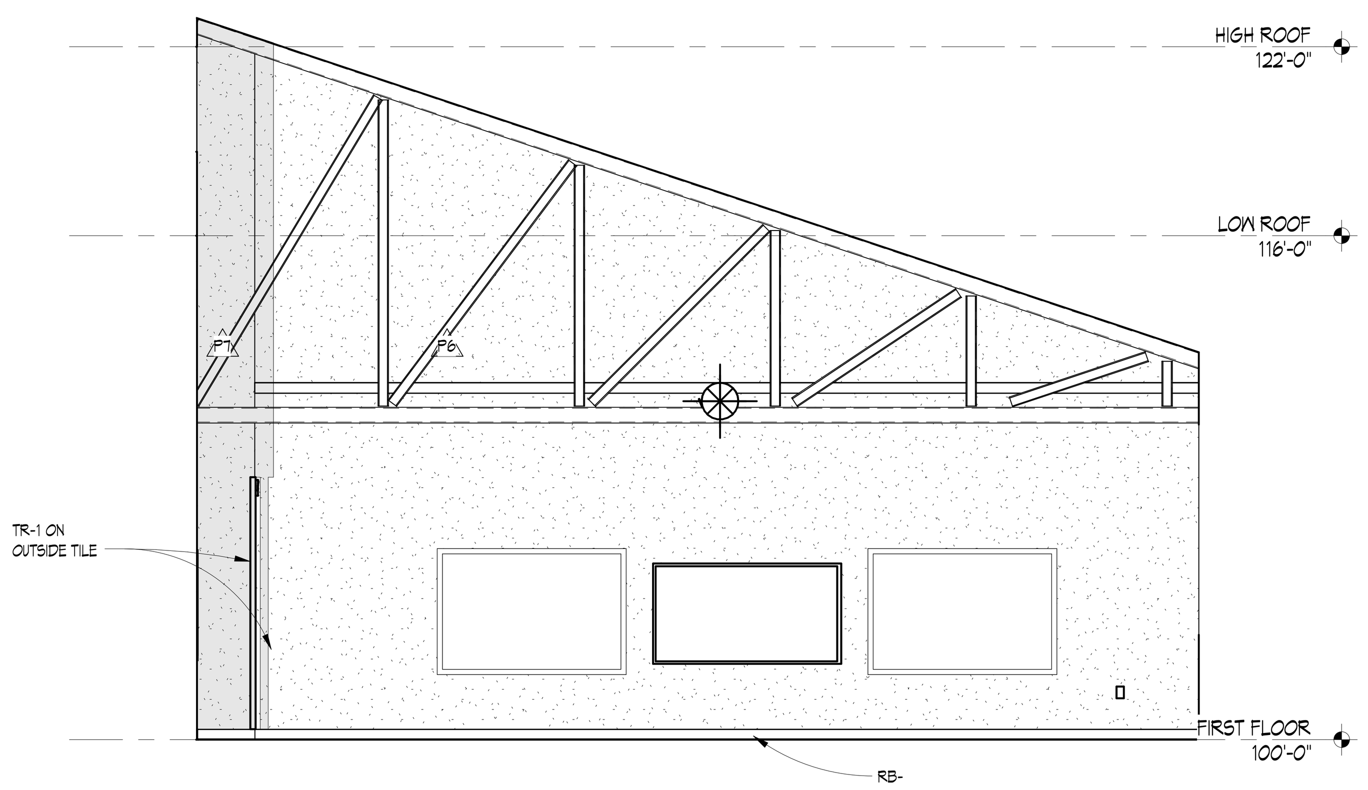
9 BOY'S TOILET ROOM
1/4" = 1'-0"



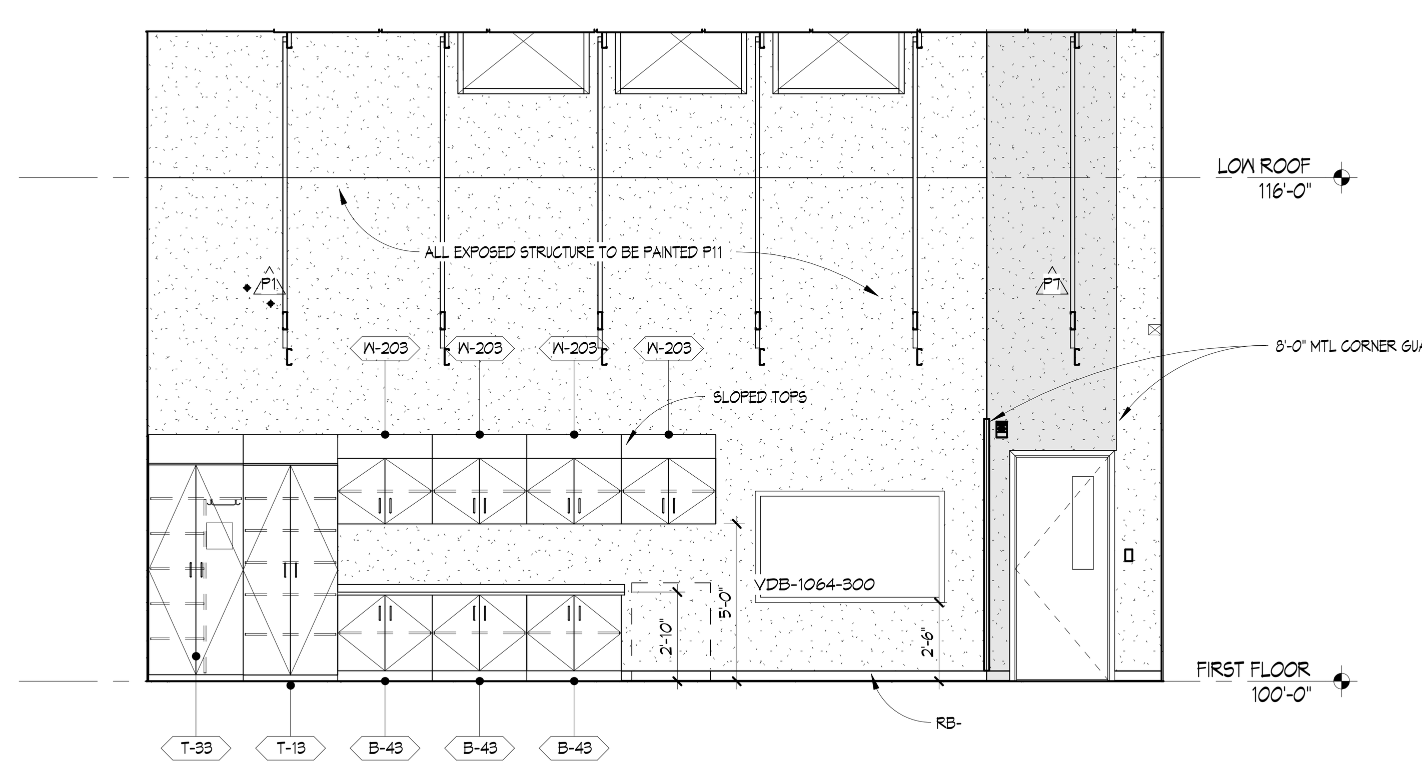
8 GIRL'S TOILET RM.
1/4" = 1'-0"



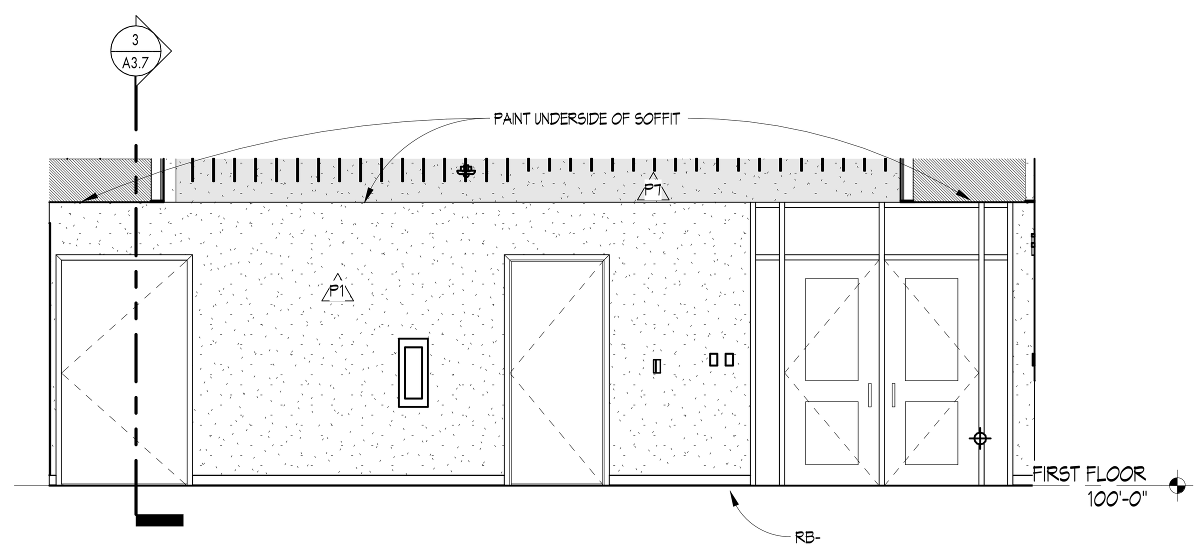
7 CLASSROOM (TYP.)-UNIT 300
1/4" = 1'-0"



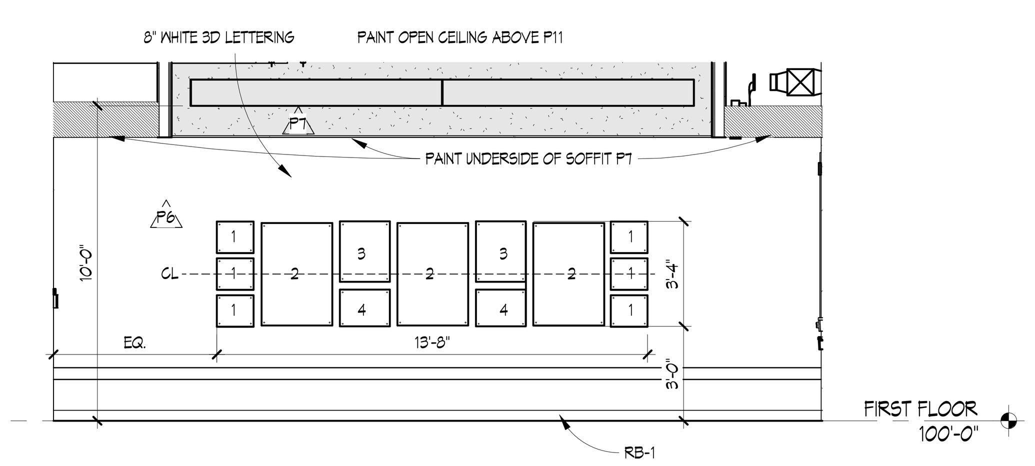
6 TEACHING WALL (TYP.) -UNIT 300
1/4" = 1'-0"



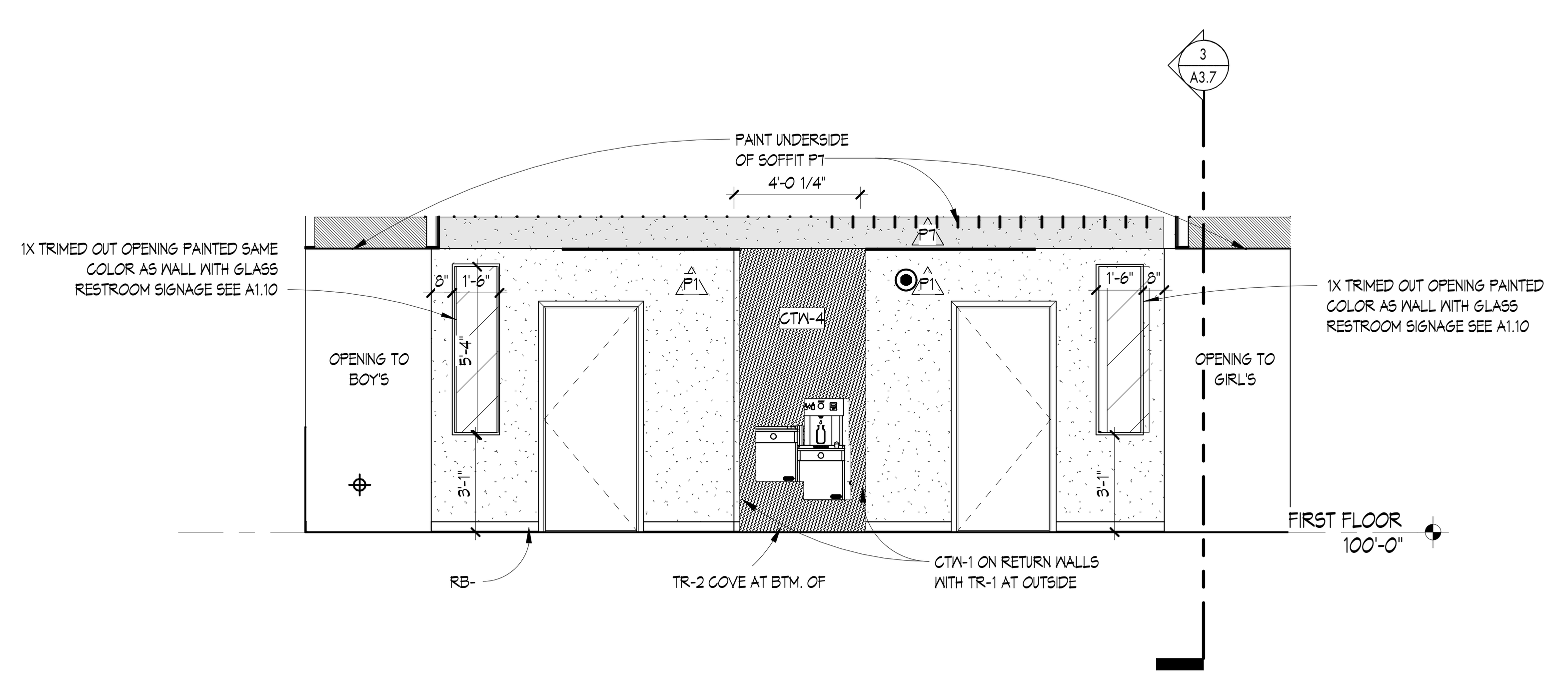
5 CLASSROOM CASEWORK (TYP.) -UNIT 300
1/4" = 1'-0"



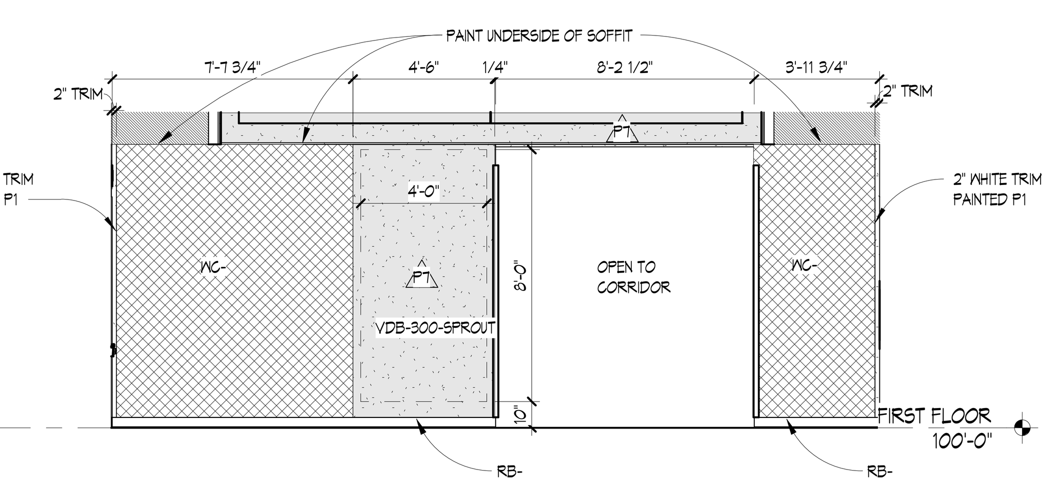
4 COLLABORATIVE CORIDOOR ENTRY-UNIT 300
1/4" = 1'-0"



3 ART DISPLAY- UNIT 300
1/4" = 1'-0"



2 RESTROOM ENTRY-UNIT 300
1/4" = 1'-0"



1 COLLABORATIVE CORIDOOR- UNIT 300
1/4" = 1'-0"

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Willow School
Lansing School District
1012 W. Willow
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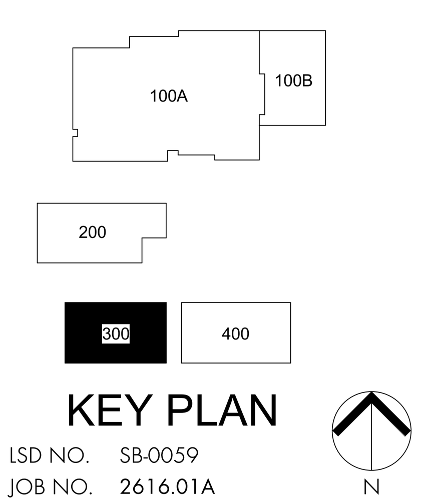
Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
INTERIOR ELEVATIONS-UNIT 300

SHEET NO.
A9.7

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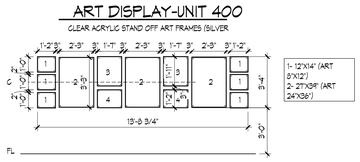
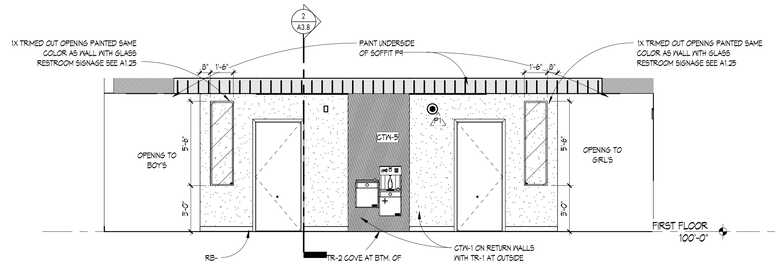
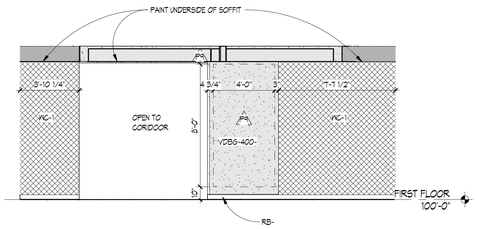


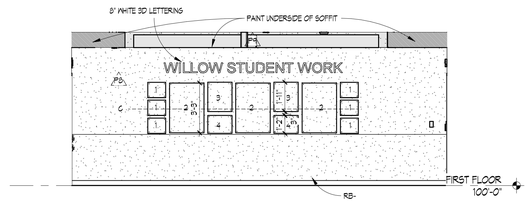
1 ART DISPLAY-UNIT 400
1/4" = 1'-0"



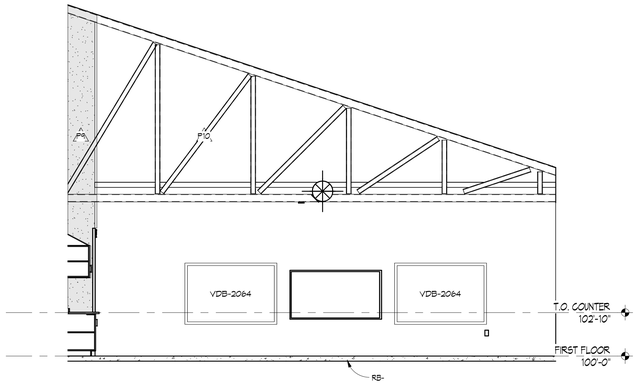
3 TOILET ROOM ENTRY- UNIT 400
1/4" = 1'-0"



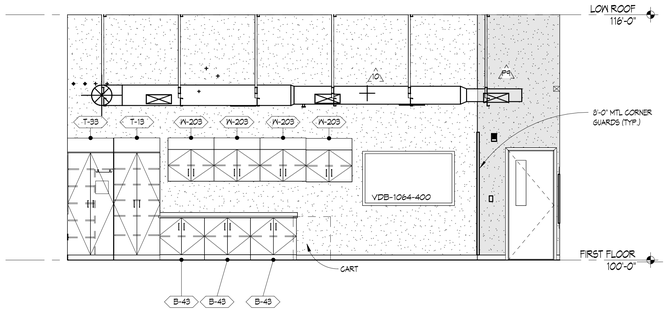
2 COLLABORATION CORIDOOR- UNIT 400
1/4" = 1'-0"



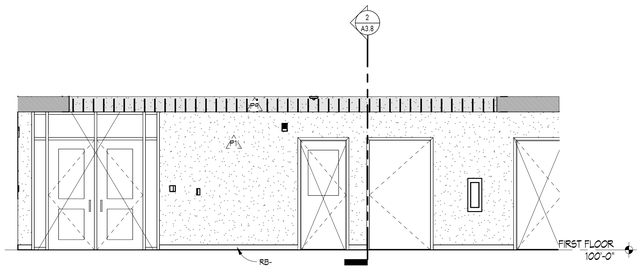
1 ART DISPLAY-UNIT 400
1/4" = 1'-0"



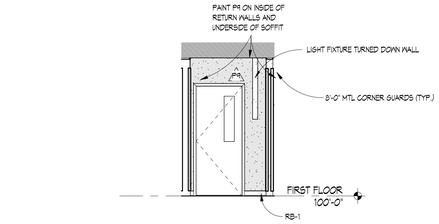
6 TEACHING WALL (TYP.) -UNIT 400
1/4" = 1'-0"



5 CLASSROOM CASEWORK (TYP.) -UNIT 400
1/4" = 1'-0"



4 COLLABORATION CORIDOOR ENTRY- UNIT 400
1/4" = 1'-0"



10 CLASSROOM ENTRY (TYP.)-UNIT 400
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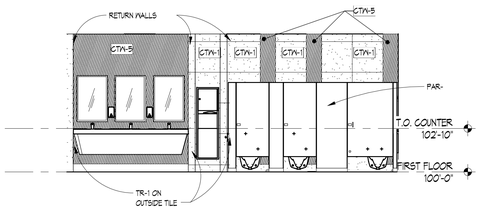
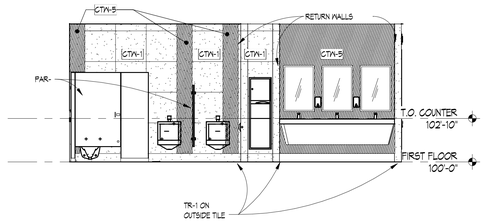
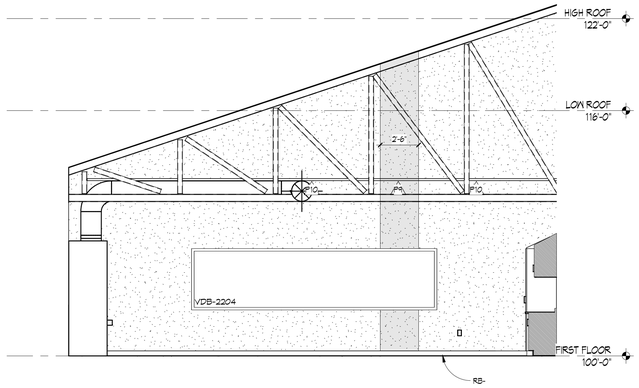


9 GIRL'S TOILET ROOM- UNIT 400
1/4" = 1'-0"



8 BOY'S TOILET ROOM- UNIT 400
1/4" = 1'-0"



7 CLASSROOM (TYP.)-UNIT 400
1/4" = 1'-0"

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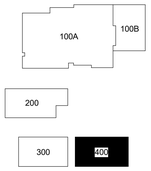
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01/26/2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
INTERIOR ELEVATIONS-UNIT 400

SHEET NO.
A9.8

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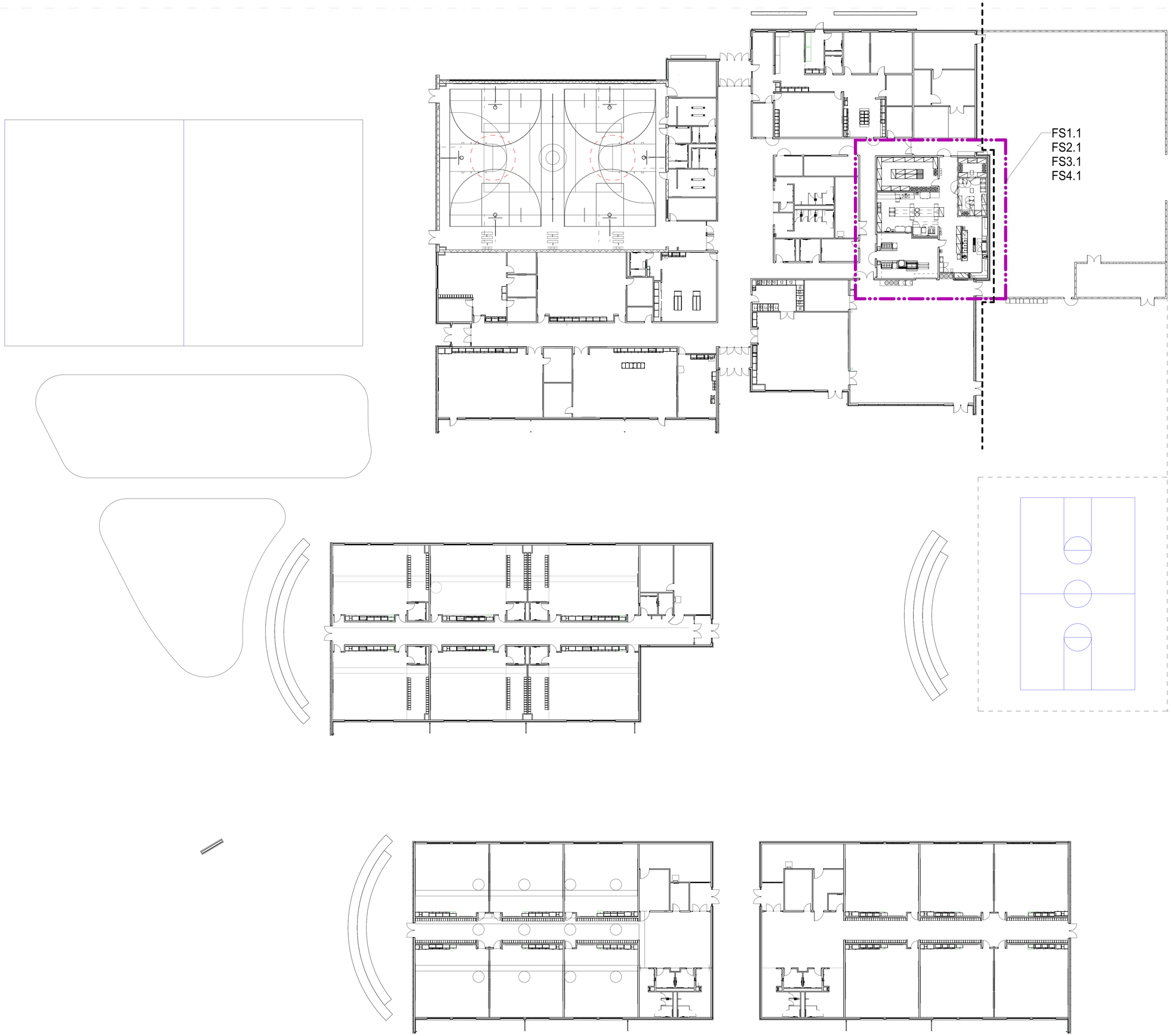

1 FOODSERVICE OVERALL PLAN
1/16" = 1'-0"

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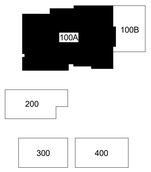
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
Bid & Construction	01/26/2024



KEY PLAN

LSD SB-005
JOB 230538

N

SHEET TITLE
OVERALL FOODSERVICE EQUIPMENT PLAN

SHEET NO.
FS1.0

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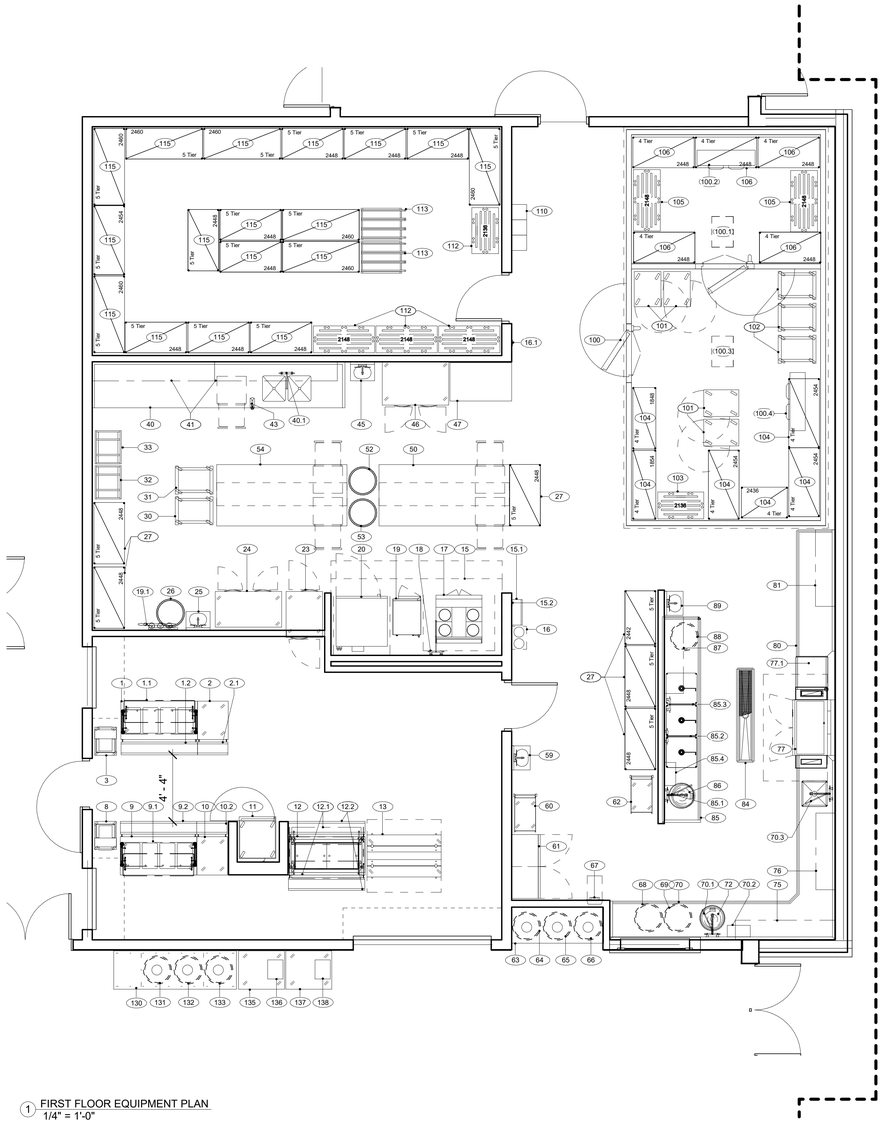

1 FIRST FLOOR EQUIPMENT PLAN
1/4" = 1'-0"

EQUIPMENT SCHEDULE KEY

O.F.O.I	OWNER FURNISHED, OWNER INSTALLED
V.F.V.I	VENDOR FURNISHED, VENDOR INSTALLED
N.I.F.E.C.	NOT IN FOODSERVICE EQUIPMENT CONTRACT

EQUIPMENT SCHEDULE

ITEM #	EQUIPMENT DESCRIPTION	NOTES
1	HOT SERVING COUNTER	
1.1	BREATH PROTECTION	
1.2	TRAY SLIDE	
2	SERVING COUNTER	
2.1	TRAY SLIDE	
3	TRAY RACK DISPENSER	
8	TRAY RACK DISPENSER	
9	HOT FOOD SERVING COUNTER	
9.1	BREATH PROTECTION	
9.2	TRAY SLIDE	
10	SERVING COUNTER	
10.2	TRAY SLIDE	
11	HOT HOLDING CABINET	
12	COLD SERVING COUNTER	
12.1	DOUBLE SIDED BREATH PROTECTION	
12.2	TRAY SLIDE	
13	MILK COOLER	
15	VENTILATION HOOD	
15.1	HOOD CONTROL BOX	
15.2	USER CONTROL INTERFACE	
16	FIRE SUPPRESSION SYSTEM	
16.1	FIRE SUPPRESSION PULL STATION	SUGGESTED LOCATION
17	INDUCTION RANGE	
18	FILLER FAUCET	
19	CONVECTION STEAMER	
20	CONVECTION OVEN	
23	PASS-THRU REFRIGERATOR	
24	REACH-IN FREEZER	
25	HANDSINK	
26	TRASH CAN	O.F.O.I.
27	STORAGE RACK	
30	PAN RACK	
31	PAN RACK	
32	BREAD RACK	V.F.V.I.
33	BREAD RACK	N.I.F.E.C.
40	WORKTABLE WITH SINKS AND DRAWERS	
40.1	FAUCET	
41	OVERSHELF	
43	CAN OPENER	
45	HANDSINK	
46	REACH IN REFRIGERATOR	
47	DESK	N.I.F.E.C.
50	WORKTABLE WITH DRAWERS AND OVERSHELF	
52	TRASH CAN	O.F.O.I.
53	COMPOSTING CAN	O.F.O.I.
54	WORKTABLE WITH DRAWERS AND OVERSHELF	
59	HANDSINK	
60	UTILITY CART	1
61	SAFETY CABINET	
62	UTILITY CART	
63	SCRAPPING STATION	
64	TRASH CAN	O.F.O.I.
65	RECYCLING CAN	O.F.O.I.
66	COMPOSTING CAN	O.F.O.I.
67	EYE WASH STATION	
68	TRASH CAN	O.F.O.I.
69	COMPOSTING CAN	O.F.O.I.
70	SOILED DISHTABLE WITH SINK	
70.1	PRE-RINSE FAUCET	
70.2	SANITIZER	N.I.F.E.C.
70.3	PRE-RINSE FAUCET	
72	DISPOSER	
75	OVERSHELF	
76	OVERSHELF	
77	DISH MACHINE	
77.1	BLOWER DRYER	
80	CLEAN DISHTABLE	
81	OVERSHELF	
84	FLOOR TROUGH	
85	THREE COMPARTMENT SINK	
85.1	PRE-RINSE FAUCET	
85.2	FAUCET	
85.3	FAUCET	
85.4	SANITIZER	N.I.F.E.C.
86	DISPOSER	
87	OVERSHELF	
88	TRASH CAN	O.F.O.I.
89	HANDSINK	
100	WALK-IN COOLER / FREEZER	
100.1	WALK-IN FREEZER CONDENSER	LOCATION PER MECH DWGS
100.2	WALK-IN FREEZER EVAPORATOR	
100.3	WALK-IN COOLER CONDENSER	LOCATION PER MECH DWGS
100.4	WALK-IN COOLER EVAPORATOR	
101	ENCLOSED PAN RACK	
102	PAN RACK	
103	DUNNAGE RACK	
104	STORAGE RACK	
105	DUNNAGE RACK	
106	STORAGE RACK	
110	LOCKERS	N.I.F.E.C.
112	DUNNAGE RACK	1
113	CAN RACK	
115	STORAGE RACK	
130	MOBILE SCRAPPING STATION	
131	TRASH CAN	O.F.O.I.
132	RECYCLING CAN	O.F.O.I.
133	COMPOSTING CAN	O.F.O.I.
135	SERVING COUNTER	
136	FLATWARE HOLDER	
137	SERVING COUNTER	
138	FLATWARE HOLDER	

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Willow School

Lansing School District

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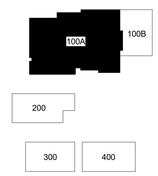
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023
ADDENDUM 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 230538

N

SHEET TITLE
FOODSERVICE EQUIPMENT PLAN

SHEET NO.
FS1.1

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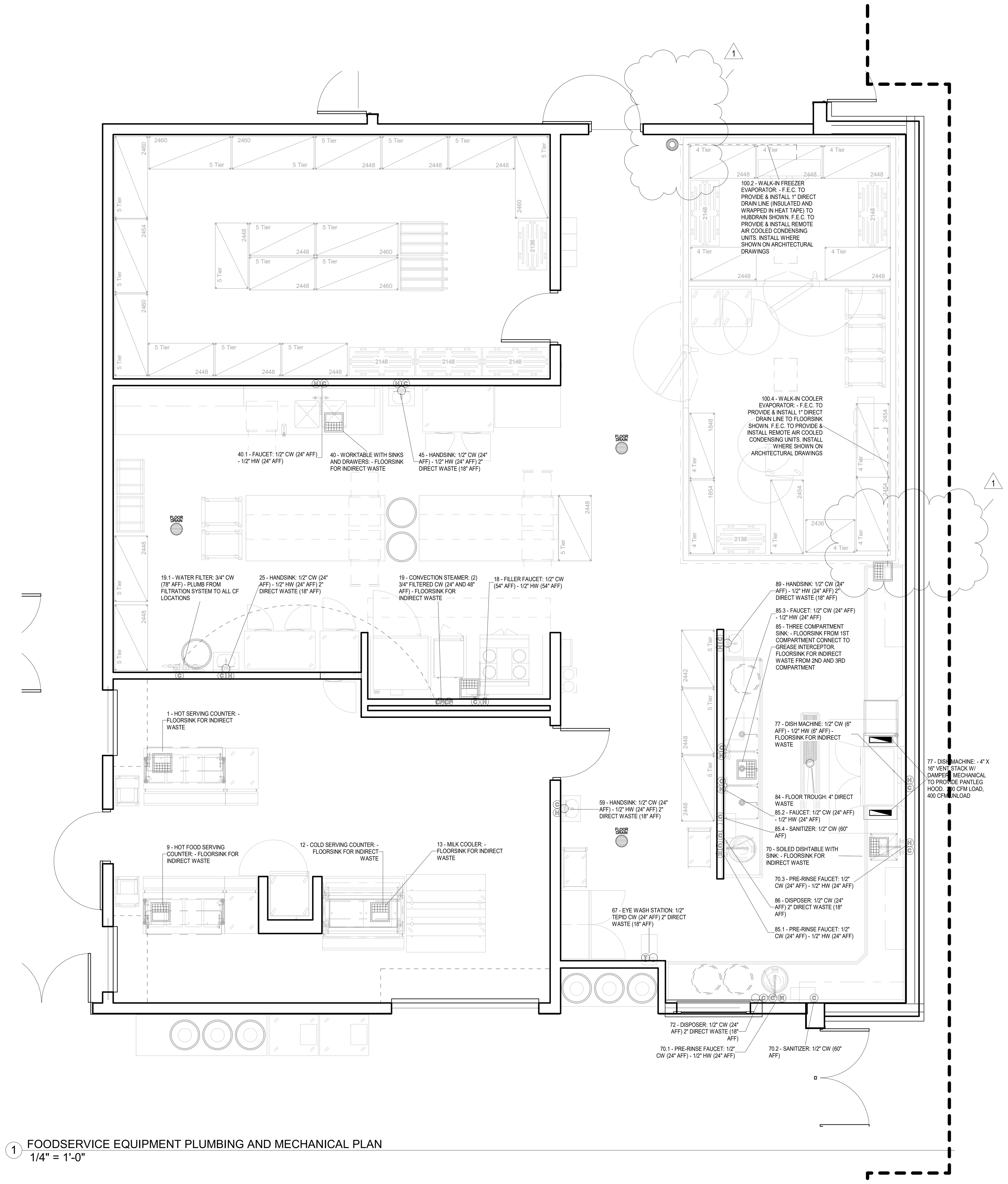


1 FOODSERVICE EQUIPMENT PLUMBING AND MECHANICAL PLAN
1/4" = 1'-0"

MECHANICAL AND PLUMBING F.E.C. NOTES

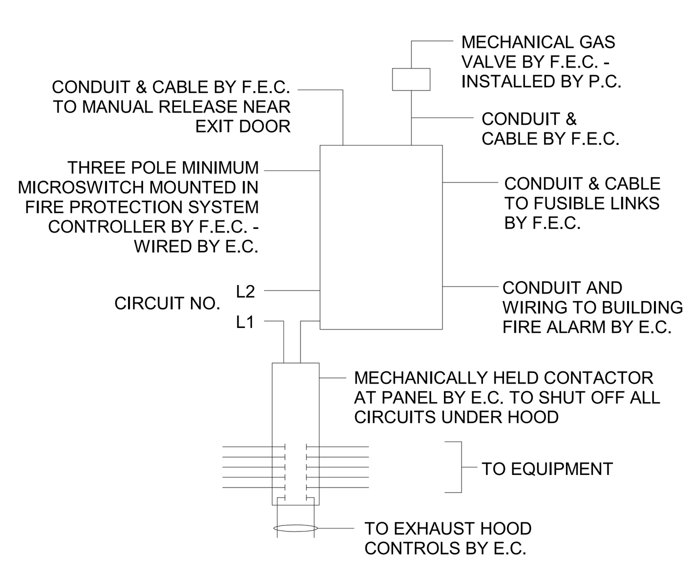
1. THIS DRAWING AND THE DATA CONTAINED HEREIN ARE PROVIDED FOR BIDDING PURPOSES ONLY AND ARE NOT INTENDED AS ROUGH-IN DRAWINGS TO BE USED ON THE PROJECT SITE. THE FOODSERVICE EQUIPMENT CONTRACTOR SHALL PROVIDE FINAL DIMENSIONED ROUGH-IN DRAWINGS AND EQUIPMENT DATA FOR CONSTRUCTION PURPOSES.
2. REFER TO THE DIVISION 11 40 00 GENERAL AND ITEM SPECIFICATIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
3. THE F.E.C. SHALL VERIFY UTILITY REQUIREMENTS OF VENDOR PROVIDED EQUIPMENT, OWNER'S EXISTING EQUIPMENT SCHEDULED FOR RE-USE, AND EQUIPMENT INTENDED FOR FUTURE PURCHASE.
4. ALL GAS EQUIPMENT LOCATED BENEATH VENTILATION HOODS SHALL BE AUTOMATICALLY SHUT OFF WHEN THE FIRE PROTECTION SYSTEM IS ACTIVATED. THE F.E.C. SHALL PROVIDE THE AUTOMATICALLY ACTIVATED GAS SHUT-OFF VALVE(S) FOR INSTALLATION BY MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR TO COORDINATE INSTALLATION WITH FIRE PROTECTION SYSTEM MANUFACTURER. M.C. TO PROVIDE SEPARATE MANUAL GAS SHUT-OFF VALVE FOR EACH CONNECTION TO GAS-FIRED EQUIPMENT.
5. THE F.E.C. SHALL LOCATE AND INSTALL THE FOODSERVICE VENTILATION CANOPIES ONLY.
6. ALL REFRIGERATION AND PLUMBING WORK RELATED TO THE WALK-IN REFRIGERATOR AND/OR FREEZER SHALL BE BY THE F.E.C. ALL PENETRATIONS FOR REFRIGERATION LINES SHALL BE THROUGH THE WALLS OF THE WALK-IN. THERE WILL BE NO PENETRATIONS THROUGH THE CEILING PANELS OF THE WALK-IN REFRIGERATOR/FREEZER FOR REFRIGERATION LINES. ALL PENETRATIONS FOR CONDUIT AND REFRIGERATION LINES SHALL BE SEALED WITH FOAM TO INSURE THAT THERE IS NO AIR INFILTRATION.
7. THE F.E.C. SHALL LOCATE AND INSTALL AIR-COOLED WALK-IN COMPRESSORS WHERE SHOWN ON DRAWINGS.
8. OPEN NOTE
9. ALL REQUIRED ROOF OPENINGS, STRUCTURAL SUPPORT, FLASHING, ETC., TO BE PERFORMED BY TRADES OTHER THAN THE FOODSERVICE EQUIPMENT CONTRACTOR.

MECHANICAL AND PLUMBING TRADES NOTES

A. ROUGH IN UTILITY LINES THROUGH WALLS, FLOORS AND CEILINGS. MAKE ALL FINAL UTILITY CONNECTIONS BETWEEN THE ROUGH-IN POINT AND THE FOODSERVICE EQUIPMENT.
B. ALL WORK MUST MEET ALL APPLICABLE STATE AND LOCAL CODES AND SITE CONDITIONS.
C. ALL EXPOSED PLUMBING FOR DRAINS SHALL BE RUN CLOSE TO THE COUNTERTOP SURFACE, GRADUALLY SLOPING TOWARDS DRAIN LOCATION. PLUMBING SHALL NOT GO BELOW 6" A.F.F. UNLESS OVER DRAIN.
D. TO MINIMIZE CLEANING AND CORROSION PROBLEMS, ALL EXPOSED PIPING (ABOVE COUNTER HEIGHT OR IN A DIRECT LINE OF SIGHT) SHALL BE STAINLESS STEEL OR CHROME PLATED. INSTALL STAINLESS STEEL OR CHROME PLATED BRASS ESCUTCHEONS OR FLANGES FOR UTILITY LINES WHICH EXTEND THROUGH WALLS AND EQUIPMENT. ALL EXPOSED STEAM SUPPLY AND RETURN LINES SHALL BE INSULATED WITH A SEAMLESS, WHITE, HEAT TOLERANT VINYL COVERS WITH ACCESS TO VALVES.
E. PROVIDE TRAPS, CONNECTING PIPE, SHUT-OFF VALVES, STOPS, FLOOR DRAINS, FLOOR SINKS, DRAIN MANIFOLDS, VACUUM BREAKERS THAT ARE NOT SPECIFIC TO EQUIPMENT, GREASE TRAPS AND ALL OTHER HARDWARE, PARTS AND SUPPLIES NECESSARY FOR THE PERFORMANCE OF WORK UNDER THIS CONTRACT, UNLESS SUPPLIED BY THE F.E.C. OR SPECIFIED OTHERWISE IN THESE DOCUMENTS.
F. PROPERLY INSTALL ALL DRAIN ASSEMBLIES, SHUT-OFF VALVES, AND INTERCONNECTING PIPING FOR THE FOODSERVICE EQUIPMENT INCLUDING, BUT NOT LIMITED TO: FAUCETS, SINK DRAINS, SINK WASTE VALVES, OVERFLOW CONNECTIONS, DISPOSER PIPING, TROUGHVEYORS, HOT FOOD WELLS, FLOOR TROUGHS AND OTHER EQUIPMENT ASSOCIATED WITH THIS PROJECT. ALL DRAIN ASSEMBLIES MUST BE INSTALLED PER ALL LOCAL HEALTH DEPARTMENT PREVAILING CODES AND BE COMMERCIAL GRADE.
G. PROVIDE ANY REQUIRED VACUUM BREAKERS NOT ALREADY SUPPLIED BY THE F.E.C. INSTALL ALL VACUUM BREAKERS. VACUUM BREAKERS, APPROVED BY THE LOCAL HEALTH DEPARTMENT, MUST BE PROVIDED ON ALL DISPOSERS, HOSE REELS, MOPSINKS, PRESSURE WASHERS, STEAMERS AND ON ALL BEVERAGE EQUIPMENT REQUIRING A WATER CONNECTION. ALL ATMOSPHERIC VACUUM BREAKERS MUST BE LOCATED DOWNSTREAM OF SHUT-OFF VALVES IN ACCORDANCE WITH HEALTH DEPARTMENT CODES.
H. F.E.C. TO PROVIDE UTILITY AND PREPARATION SINKS WITH TWIST HANDLE 2" WASTE OUTLETS WITH OVERFLOW ASSEMBLIES. F.E.C. TO PROVIDE LOOSE FOR INSTALLATION.
I. OPEN NOTE
J. OPEN NOTE
K. OPEN NOTE
L. ROUGH-IN LINES FOR WATER TREATMENT SYSTEMS TO BE IN WALL. RUN TREATED WATER PIPE TO COOKING AND BEVERAGE EQUIPMENT IN WALL. DO NOT RUN PIPE EXPOSED ON WALL.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A.F.F.	ABOVE FINISHED FLOOR		FULL-GRATE FLOORSINK (12" SQUARE)
D.F.A.	DOWN FROM ABOVE		1/2 GRATE FLOORSINK (12" SQUARE)
F.E.C.	FOODSERVICE EQUIPMENT CONTRACTOR	H	HOT WATER
G.C.	GENERAL CONTRACTOR	C	COLD WATER
M.C.	MECHANICAL CONTRACTOR	HF	FILTERED HOT WATER
Q.D.G.H.	QUICK DISCONNECT GAS HOSE	CF	FILTERED COLD WATER
	FUNNEL-TYPE FLOOR DRAIN (SANITARY)	S	STEAM SUPPLY
	DIRECT CONNECT DRAIN	R	CONDENSATE RETURN
FLOOR DRAIN	FLOORDRAIN (MINIMAL FLOOR SLOPE TO DRAIN)	T	TEPID WATER
	ROUND FLOORSINK (12" DIAMETER MIN.)		FLEXIBLE QUICK RELEASE GAS SUPPLY

PLUMBING / MECHANICAL SYMBOL LEGEND
1/4" = 1'-0"



TYPICAL FIRE PROTECTION SYSTEM CONTROL DIAGRAM
SEE F.E.C. SHOP DRAWINGS FOR EXACT REQUIREMENTS

UPON ACTIVATION OF THE FIRE PROTECTION SYSTEM, SHUT DOWN THE SUPPLY FAN. EXHAUST FAN SHALL CONTINUE TO RUN OR SHALL BE SHUT DOWN AS DIRECTED BY THE FIRE MARSHALL AND THE HEALTH DEPARTENT. VERIFY WITH LOCAL INSPECTORS. E.C. TO PROVIDE CONTROLS AND WIRING AS REQUIRED.

2 TYP. FIRE PROTECTION SYSTEM CONTROL DIAGRAM
NOT TO SCALE

PLUMBING AND MECHANICAL SCHEDULE

ITEM #	EQUIPMENT	GAS SIZE	MBTU	GAS AFF	CW SIZE	CW AFF	HW SIZE	HW AFF	DRAIN SIZE	DRAIN AFF	PLUMBING NOTES	MECHANICAL NOTES
1	HOT SERVING COUNTER										FLOORSINK FOR INDIRECT WASTE	
9	HOT FOOD SERVING COUNTER										FLOORSINK FOR INDIRECT WASTE	
12	COLD SERVING COUNTER										FLOORSINK FOR INDIRECT WASTE	
13	MILK COOLER										FLOORSINK FOR INDIRECT WASTE	
18	FILLER FAUCET				1/2"	54"	1/2"	54"				
19	CONVECTION STEAMER				(2) 3/4" FILTERED	24" AND 48"					FLOORSINK FOR INDIRECT WASTE	
19.1	WATER FILTER				3/4"	78"					PLUMB FROM FILTRATION SYSTEM TO ALL CF LOCATIONS	
25	HANDSINK				1/2"	24"	1/2"	24"	2" DIRECT	18"		
40	WORKTABLE WITH SINKS AND DRAWERS										FLOORSINK FOR INDIRECT WASTE	
40.1	FAUCET				1/2"	24"	1/2"	24"				
45	HANDSINK				1/2"	24"	1/2"	24"	2" DIRECT	18"		
59	HANDSINK				1/2"	24"	1/2"	24"	2" DIRECT	18"		
67	EYE WASH STATION				1/2" TEPID	24"			2" DIRECT	18"		
70	SOILED DISHTABLE WITH SINK										FLOORSINK FOR INDIRECT WASTE	
70.1	PRE-RINSE FAUCET				1/2"	24"	1/2"	24"				
70.2	SANITIZER				1/2"	60"						
70.3	PRE-RINSE FAUCET				1/2"	24"	1/2"	24"				
72	DISPOSER				1/2"	24"			2" DIRECT	18"		
77	DISH MACHINE				1/2"	6"	1/2"	6"			FLOORSINK FOR INDIRECT WASTE	4" X 16" VENT STACK W/ DAMPER. MECHANICAL TO PROVIDE PANTLEG HOOD. 200 CFM LOAD, 400 CFM UNLOAD
84	FLOOR TROUGH								4" DIRECT			
85	THREE COMPARTMENT SINK								2" WASTE	18"	FLOORSINK FROM 1ST COMPARTMENT CONNECT TO GREASE INTERCEPTOR. FLOORSINK FOR INDIRECT WASTE FROM 2ND AND 3RD COMPARTMENT	
85.1	PRE-RINSE FAUCET				1/2"	24"	1/2"	24"				
85.2	FAUCET				1/2"	24"	1/2"	24"				
85.3	FAUCET				1/2"	24"	1/2"	24"				
85.4	SANITIZER				1/2"	60"						
86	DISPOSER				1/2"	24"			2" DIRECT	18"		
89	HANDSINK				1/2"	24"	1/2"	24"	2" DIRECT	18"		
100.2	WALK-IN FREEZER EVAPORATOR										F.E.C. TO PROVIDE & INSTALL 1" DIRECT DRAIN LINE (INSULATED AND WRAPPED IN HEAT TAPE) TO HUBDRAIN SHOWN. F.E.C. TO PROVIDE & INSTALL REMOTE AIR COOLED CONDENSING UNITS. INSTALL WHERE SHOWN ON ARCHITECTURAL DRAWINGS	
100.4	WALK-IN COOLER EVAPORATOR										F.E.C. TO PROVIDE & INSTALL 1" DIRECT DRAIN LINE TO FLOORSINK SHOWN. F.E.C. TO PROVIDE & INSTALL REMOTE AIR COOLED CONDENSING UNITS. INSTALL WHERE SHOWN ON ARCHITECTURAL DRAWINGS	

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Lansing School District
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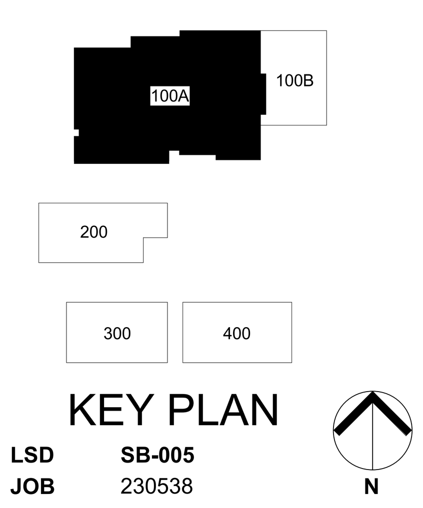
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023
ADDENDUM 01	03/01/2024



KEY PLAN

LSD SB-005
JOB 230538

SHEET TITLE: FOODSERVICE PLUMBING / MECHANICAL PLAN

SHEET NO. FS2.1

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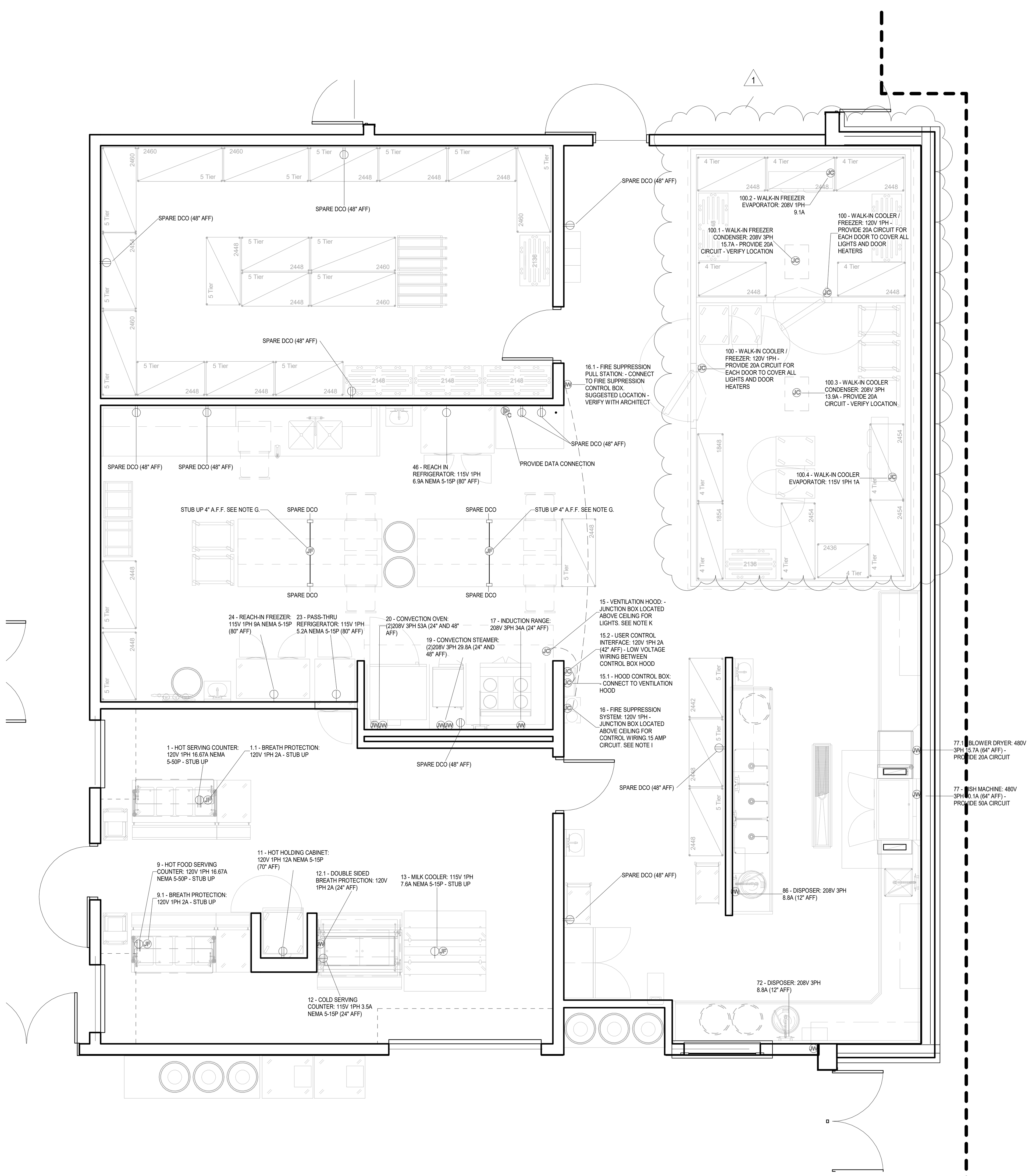
PLEASE RECYCLE

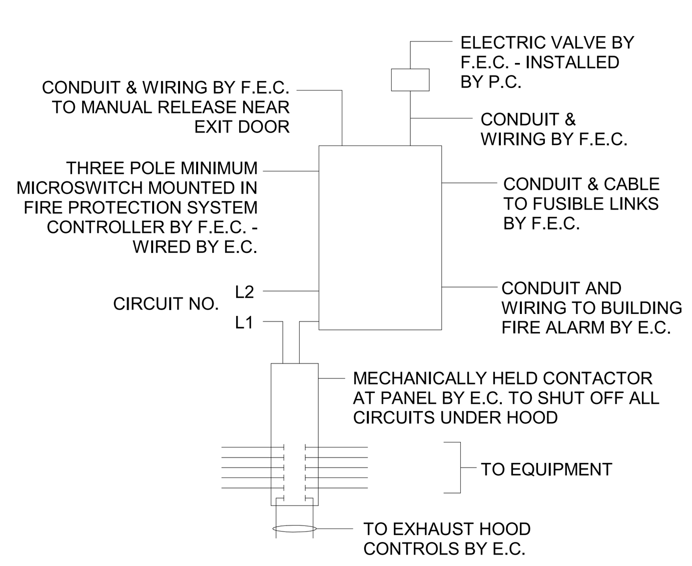
1. FOODSERVICE EQUIPMENT ELECTRICAL PLAN
1/4" = 1'-0"



ELECTRICAL SCHEDULE

ITEM #	EQUIPMENT	VOLTS	PHASE	AMPS	NEMA	HEIGHT A.F.F.	ELECTRICAL NOTES
1	HOT SERVING COUNTER	120	1	16.67	5-50P		STUB UP
1.1	BREATH PROTECTION	120	1	2			STUB UP
9	HOT FOOD SERVING COUNTER	120	1	16.67	5-50P		STUB UP
9.1	BREATH PROTECTION	120	1	2			STUB UP
11	HOT HOLDING CABINET	120	1	12	5-15P	70"	
12	COLD SERVING COUNTER	115	1	3.5	5-15P	24"	
12.1	DOUBLE SIDED BREATH PROTECTION	120	1	2		24"	
13	MILK COOLER	115	1	7.6	5-15P		STUB UP
15	VENTILATION HOOD						JUNCTION BOX LOCATED ABOVE CEILING FOR LIGHTS. SEE NOTE K
15.1	HOOD CONTROL BOX						CONNECT TO VENTILATION HOOD
15.2	USER CONTROL INTERFACE	120	1	2		42"	LOW VOLTAGE WIRING BETWEEN CONTROL BOX HOOD
16	FIRE SUPPRESSION SYSTEM	120	1				JUNCTION BOX LOCATED ABOVE CEILING FOR CONTROL WIRING.15 AMP CIRCUIT. SEE NOTE I
16.1	FIRE SUPPRESSION PULL STATION						CONNECT TO FIRE SUPPRESSION CONTROL BOX. SUGGESTED LOCATION - VERIFY WITH ARCHITECT
17	INDUCTION RANGE	208	3	34		24"	
19	CONVECTION STEAMER	(2)208	3	29.8		24" AND 48"	
20	CONVECTION OVEN	(2)208	3	53		24" AND 48"	
23	PASS-THRU REFRIGERATOR	115	1	5.2	5-15P	80"	
24	REACH-IN FREEZER	115	1	9	5-15P	80"	
40	WORKTABLE WITH SINKS AND DRAWERS						
46	REACH IN REFRIGERATOR	115	1	6.9	5-15P	80"	
72	DISPOSER	208	3	8.8		12"	
77	DISH MACHINE	480	3	40.1		64"	PROVIDE 50A CIRCUIT
77.1	BLOWER DRYER	480	3	15.7		64"	PROVIDE 20A CIRCUIT
85	THREE COMPARTMENT SINK						
86	DISPOSER	208	3	8.8		12"	
100	WALK-IN COOLER / FREEZER	120	1				PROVIDE 20A CIRCUIT FOR EACH DOOR TO COVER ALL LIGHTS AND DOOR HEATERS
100.1	WALK-IN FREEZER CONDENSER	208	3	15.7			PROVIDE 20A CIRCUIT - VERIFY LOCATION
100.2	WALK-IN FREEZER EVAPORATOR	208	1	9.1			
100.3	WALK-IN COOLER CONDENSER	208	3	13.9			PROVIDE 20A CIRCUIT - VERIFY LOCATION
100.4	WALK-IN COOLER EVAPORATOR	115	1	1			

NOTE:
SPARE DCO'S ARE NOT LISTED IN THE FOODSERVICE ELECTRICAL SCHEDULE. THE ELECTRICAL CONTRACTOR IS TO REFERENCE ALL ELECTRICAL FLOOR PLANS FOR SPARE DCO QUANTITIES AND GENERAL LOCATIONS



TYPICAL FIRE PROTECTION SYSTEM CONTROL DIAGRAM
SEE F.E.C. SHOP DRAWINGS FOR EXACT REQUIREMENTS

UPON ACTIVATION OF THE FIRE PROTECTION SYSTEM, SHUT DOWN THE SUPPLY FAN. EXHAUST FAN SHALL CONTINUE TO RUN OR SHALL BE SHUT DOWN AS DIRECTED BY THE FIRE MARSHALL AND THE HEALTH DEPARTENT. VERIFY WITH LOCAL INSPECTORS. E.C. TO PROVIDE CONTROLS AND WIRING AS REQUIRED.

2. TYP. FIRE PROTECTION SYSTEM CONTROL DIAGRAM
NOT TO SCALE

ELECTRICAL F.E.C. NOTES

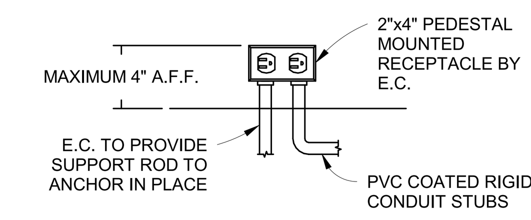
1.	THIS DRAWING AND THE DATA CONTAINED HEREIN ARE PROVIDED FOR BIDDING PURPOSES ONLY AND ARE NOT INTENDED AS ROUGH-IN DRAWINGS TO BE USED ON THE PROJECT SITE. THE F.E.C. SHALL PROVIDE FINAL DIMENSIONED ROUGH-IN DRAWINGS AND EQUIPMENT DATA FOR CONSTRUCTION PURPOSES.
2.	REFER TO THE DIVISION 11 40 00 GENERAL AND ITEM SPECIFICATIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
3.	THE F.E.C. SHALL VERIFY UTILITY REQUIREMENTS OF VENDOR PROVIDED EQUIPMENT, OWNER'S EXISTING EQUIPMENT SCHEDULED FOR RE-USE, AND EQUIPMENT INTENDED FOR FUTURE PURCHASE.
4.	THE F.E.C. SHALL LOCATE AND INSTALL THE FOODSERVICE VENTILATION CANOPIES ONLY.
5.	OPEN NOTE
6.	THE F.E.C. SHALL LOCATE AND INSTALL AIR-COOLED WALK-IN COMPRESSORS WHERE SHOWN ON DRAWINGS.
7.	THE F.E.C. SHALL LOCATE AND INSTALL THE REFRIGERATION SYSTEM COMPRESSOR RACK WHERE SHOWN ON DRAWINGS.
8.	DRAIN LINES LOCATED IN FREEZER COMPARTMENTS SHALL BE FULLY INSULATED AND WRAPPED WITH HEAT TAPE TO PREVENT CONDENSATION FROM FREEZING.
9.	ALL REQUIRED ROOF OPENINGS, STRUCTURAL SUPPORT, FLASHING, ETC., TO BE PERFORMED BY TRADES OTHER THAN THE FOODSERVICE EQUIPMENT CONTRACTOR.

ELECTRICAL TRADE NOTES

A.	ROUGH IN ELECTRICAL SERVICE THROUGH WALLS, FLOORS AND CEILINGS. MAKE ALL FINAL UTILITY CONNECTIONS BETWEEN THE ROUGH-IN POINT AND THE FOODSERVICE EQUIPMENT.
B.	ALL WORK MUST MEET ALL APPLICABLE STATE AND LOCAL CODES AND SITE CONDITIONS.
C.	FURNISH AND INSTALL ALL ELECTRICAL OUTLETS IN WALLS, FLOOR AND CEILING, AND IN OR ON FOODSERVICE EQUIPMENT WHERE NOTED ON DRAWINGS. ALL 120V DUPLEX RECEPTACLES SHALL BE MINIMUM 20 AMP CIRCUIT UNLESS NOTED OTHERWISE.
D.	FURNISH AND INSTALL ALL SAFETY CUT-OUTS, LINE DISCONNECT DEVICES, SHUNT-TRIP BREAKERS, POWER PANELS, POWER CORDS, GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLES, OUTLETS, CONDUIT, WIRE AND OTHER ELECTRICAL CONTROLS, AND ALL OTHER HARDWARE, PARTS AND SUPPLIES NECESSARY FOR THE PERFORMANCE OF WORK UNDER THIS CONTRACT, UNLESS SUPPLIED BY THE F.E.C. OR SPECIFIED OTHERWISE IN THESE DOCUMENTS.
E.	FURNISH AND INSTALL ALL CONDUIT AND WIRING BETWEEN REMOTE CONTROL PANELS AND THE FOODSERVICE EQUIPMENT.
F.	ALL CONDUIT SHALL BE RUN IN WALL AT 6" A.F.F. MINIMUM OR AS INDICATED. ALL EXPOSED CONDUIT SHALL BE RUN TIGHT TO THE WALL. DO NOT ATTACH CONDUIT TO ANY LEGS OR SHELVING BRACING. ALL EXPOSED CONDUIT SHALL BE RIGID. FLEXIBLE METAL CONDUIT MAY ONLY BE SECURED TO THE BOTTOM OF THE TABLES OR OTHER STEEL SURFACES. ALL FLEXIBLE CONDUIT SHALL BE "SEALTITE" OR EQUAL. ALL COVER PLATES SHALL BE STAINLESS STEEL.
G.	PROVIDE FINAL CONNECTIONS TO PRE-WIRED COUNTERS. ALL WIRING, CONDUIT, RECEPTACLES, JUNCTION BOXES AND G.F.C.I.s PROVIDED AS PART OF COUNTER BY F.E.C.
H.	120V 20A DEDICATED CIRCUIT PER P.O.S. SYSTEM. PROVIDE SPARE J-BOX AND CONDUIT FROM P.O.S. SYSTEM TO FOODSERVICE OFFICE, FOR COMPUTER TERMINAL. OTHER TRADES TO PROVIDE PHONE JACK FOR DATA LINK.
I.	PROVIDE AND INTERWIRE SHUNT-TRIP BREAKER TO AUTOMATICALLY SHUT DOWN ELECTRIC EQUIPMENT AND RECEPTACLES UNDER HOODS WHEN FIRE PROTECTION SYSTEM IS ACTIVATED. INTERCONNECT FIRE PROTECTION SYSTEM WITH BUILDING ALARM SYSTEM.
J.	ROUGH IN, CONNECT AND INTERCONNECT ROOFTOP EQUIPMENT FOR FOODSERVICE VENTILATION SYSTEMS. INTERCONNECT LOW VOLTAGE CONTROL WIRING FROM ROOFTOP VENTILATION PACKAGE TO CONTROL PANEL. SEE MANUFACTURERS SHOP DRAWINGS FOR JUNCTION BOX AND CONTROL PANEL LOCATIONS. SEE HVAC PLANS FOR ROOFTOP EQUIPMENT UTILITY REQUIREMENTS.
K.	120V 1PH .5KW FOR HOOD LIGHTS. CONNECT TO JUNCTION BOX ON TOP OF EXHAUST HOOD. SEE MANUFACTURERS SHOP DRAWINGS FOR JUNCTION BOX LOCATIONS.
L.	PROVIDE CONTROL WIRING BETWEEN HOOD, MASTER CONTROL PANEL AND INTERMEDIATE/LOCAL HOOD CONTROLS. MASTER CONTROL PANEL AND INTERMEDIATE/LOCAL HOOD CONTROLS SHOWN ON HVAC DRAWINGS.
M.	OPEN NOTE
N.	FURNISH AND INSTALL ALL INTERCONNECTING WIRING FOR WALK-IN REFRIGERATOR AND/OR FREEZER LIGHTS, DOOR HEATERS, COMPRESSORS, EVAPORATORS, ALARM SYSTEMS, HEATED PRESSURE RELIEF VENTS, WINDOW HEATERS, TIME CLOCKS, INTERLOCKS, ETC. UNITS ARE NOT PRE-WIRED. WIRE PER MANUFACTURER'S DRAWINGS. CONDUIT FOR WALK-IN LIGHTING SHALL BE RUN OVER TOP OF BOXES. INTERIOR CONDUIT RUNS ARE NOT ACCEPTABLE. ALL PENETRATIONS FOR CONDUIT AND REFRIGERATION LINES SHALL BE SEALED WITH FOAM TO INSURE THAT THERE IS NO AIR INFILTRATION.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A.F.F.	ABOVE FINISHED FLOOR		SINGLE POWER RECESSED RECEPTACLE TO MATCH EQUIPMENT
D.C.O.	DUPLEX CONVENIENCE OUTLET		GROUND FAULT DUPLEX RECEPTACLE
D.F.A.	DOWN FROM ABOVE		120V SINGLE RECEPTACLE
E.C.	ELECTRICAL CONTRACTOR	JC	FLUSH MOUNTED JUNCTION BOX IN CEILING
F.E.C.	FOODSERVICE EQUIPMENT CONTRACTOR	JF	FLUSH MOUNTED JUNCTION BOX IN FLOOR
G.C.	GENERAL CONTRACTOR	JW	FLUSH MOUNTED JUNCTION BOX IN WALL
	ELECTRICAL CONNECTION BUILT IN EQUIPMENT		FLUSH FLOOR RECEPTACLE WITH HINGED BRASS COVER
	48" FLUORESCENT LIGHTS		ROUTED CONNECTION

ELECTRICAL SYMBOL LEGEND
1/4" = 1'-0"



3. TYP. FLOOR RECEPTACLE
NOT TO SCALE

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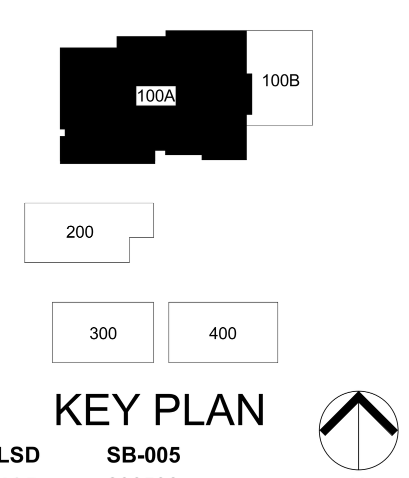
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023
ADDENDUM 01	03/01/2024



KEY PLAN

LSD SB-005
JOB 230538

SHEET TITLE: FOODSERVICE EQUIPMENT ELECTRICAL PLAN

SHEET NO. FS3.1

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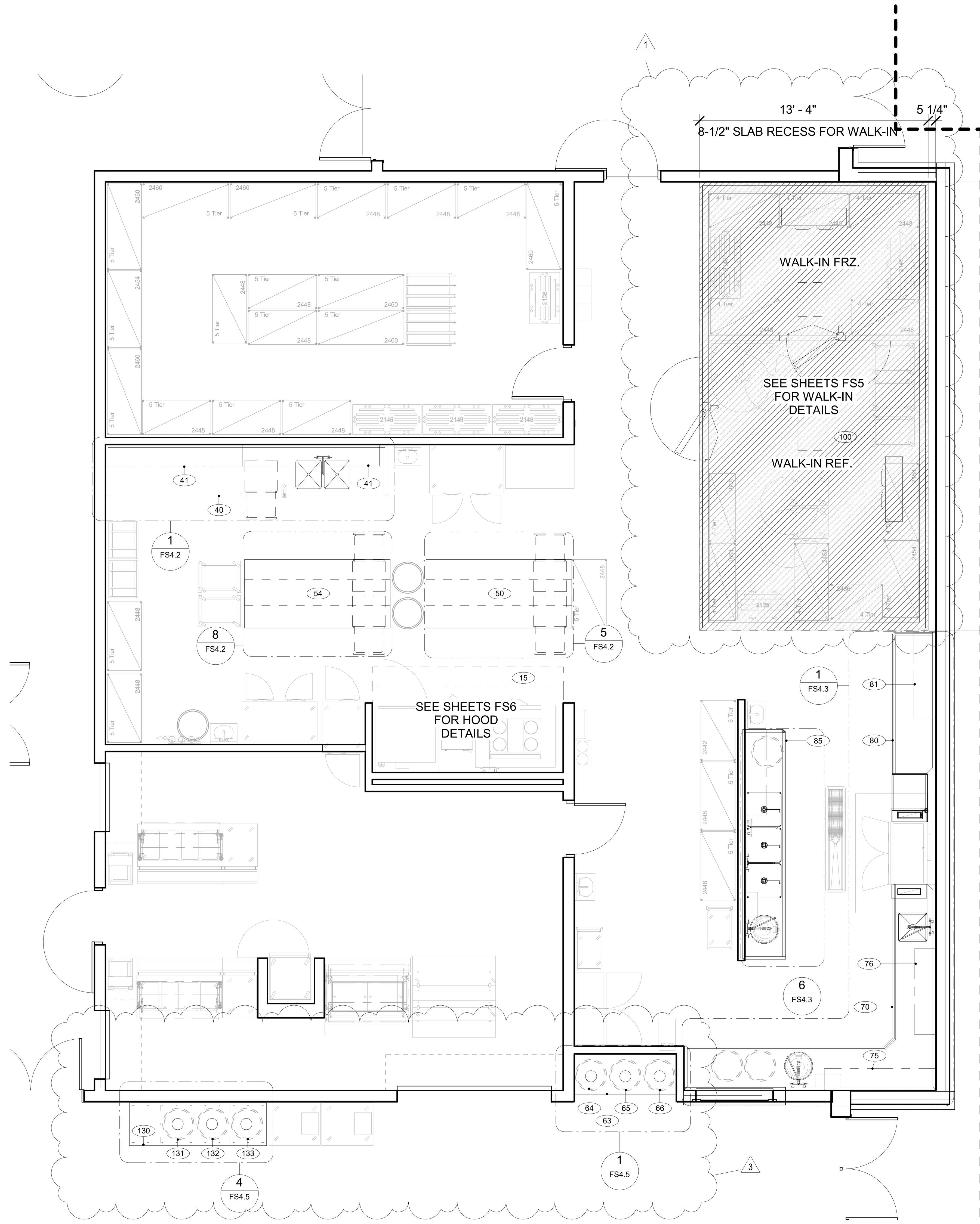

1 FOODSERVICE CALL-OUT PLAN
1/4" = 1'-0"

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ISSUANCE	DAT
CD COORDINATION	11.09.2023
ADDENDUM 01	03/01/2024
ADDENDUM 03	03/15/2024

100A 100B 200 300 400

KEY PLAN

N

LSD SB-005
JOB 230538

SHEET TITLE
SPECIAL CONDITIONS AND DETAIL CALL-OUT PLAN

SHEET NO.
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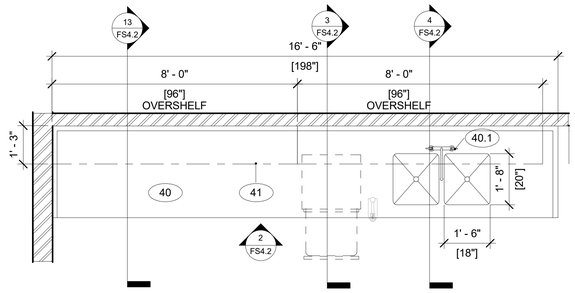

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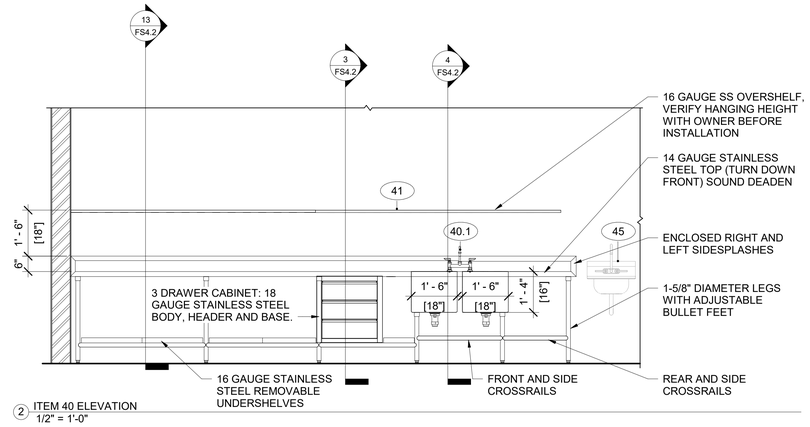

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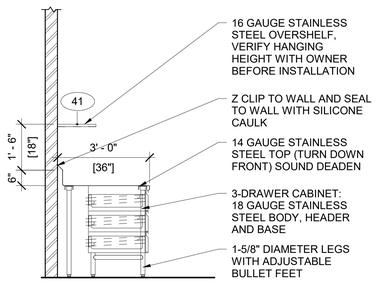

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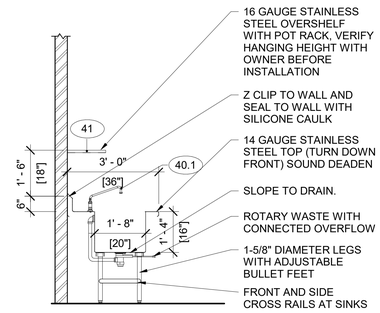

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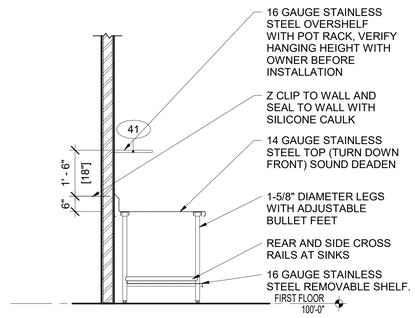

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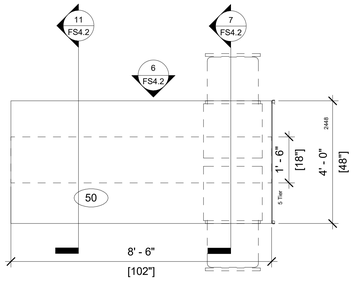

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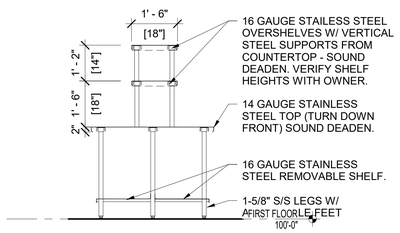

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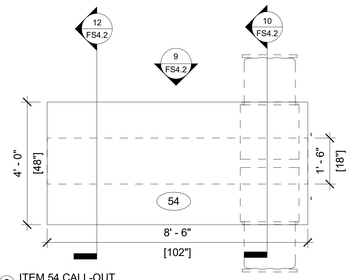
1/2" = 1'-0"



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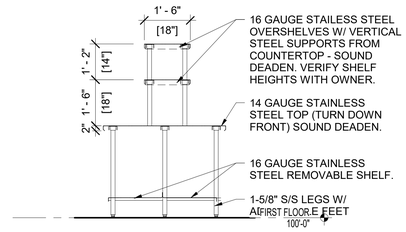

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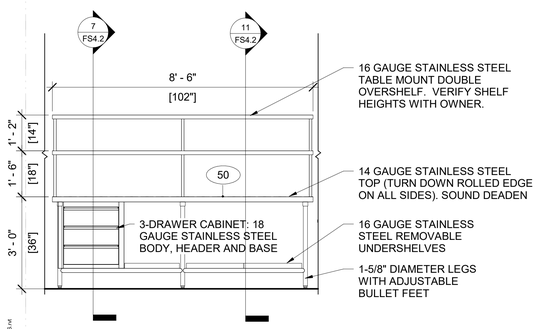

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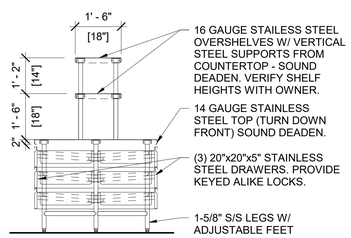
1/2" = 1'-0"



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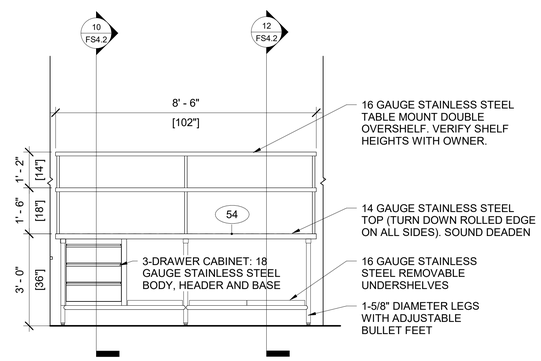

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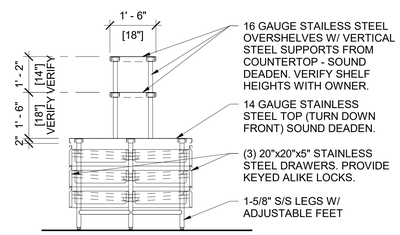

10 ITEM 54 SECTION
1/2" = 1'-0"

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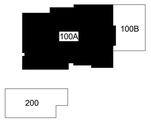
ISSUANCE	DAT
CD COORDINATION	11.09.2023



KEY PLAN

LSD SB-005
JOB 230538

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SHEET TITLE
FOODSERVICE EQUIPMENT DETAILS

SHEET NO.
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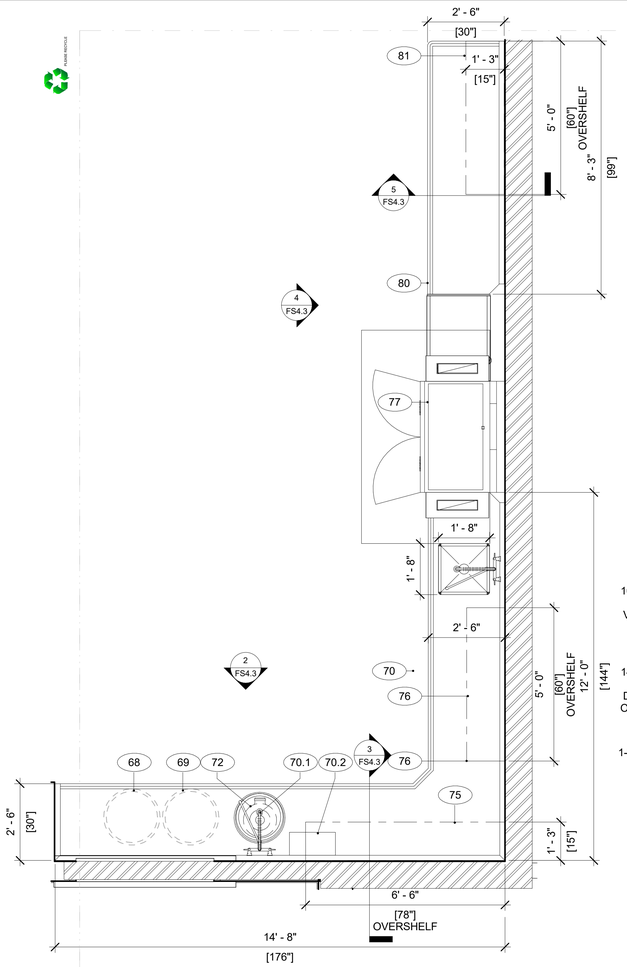
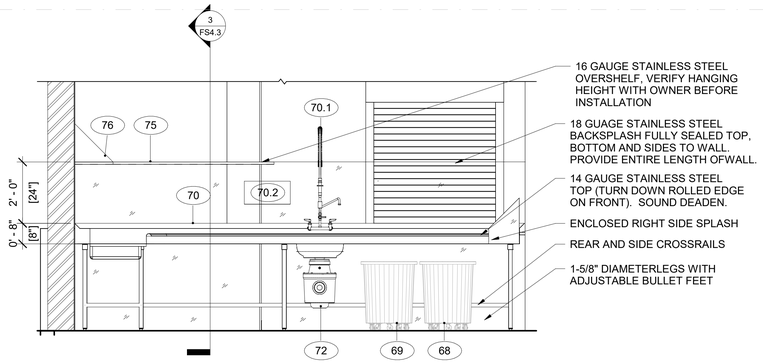


1 ITEMS 70 AND 80 CALL-OUT
1/2" = 1'-0"



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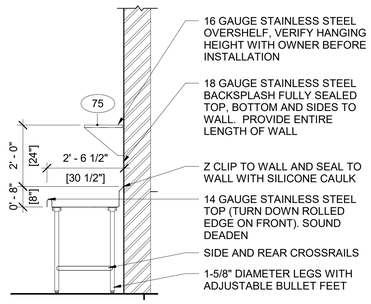

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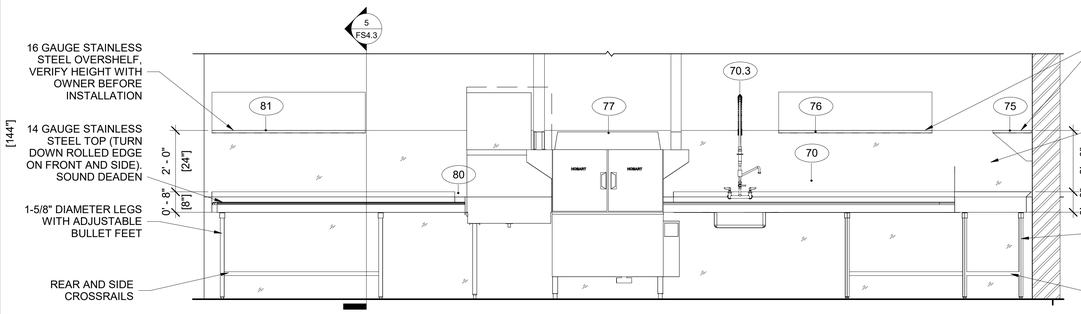

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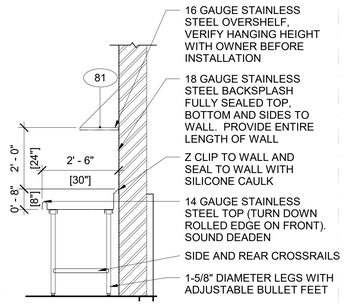

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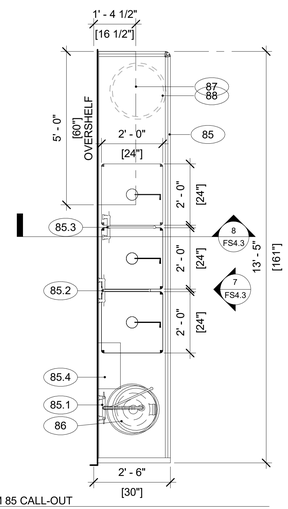
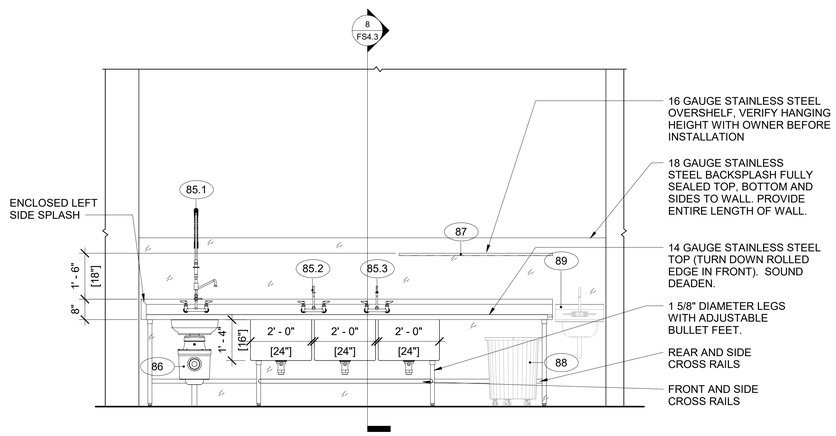


6 ITEM 85 CALL-OUT
1/2" = 1'-0"



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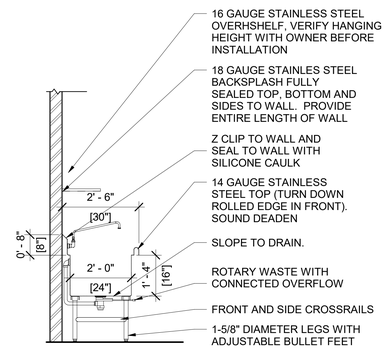

8 ITEM 85 SECTION
1/2" = 1'-0"

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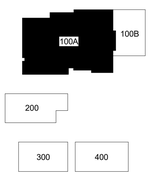
Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023



KEY PLAN

LSD SB-005
JOB 230538

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SHEET TITLE
FOODSERVICE EQUIPMENT DETAILS

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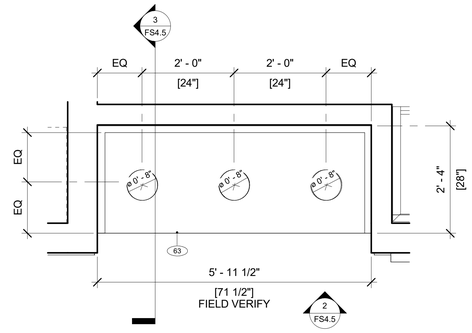

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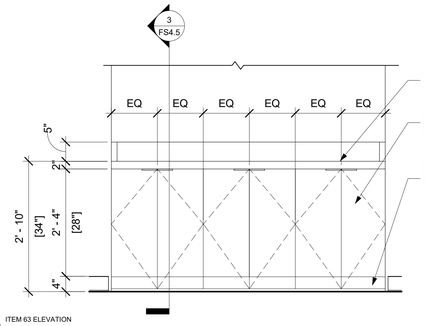
3/4" = 1'-0"

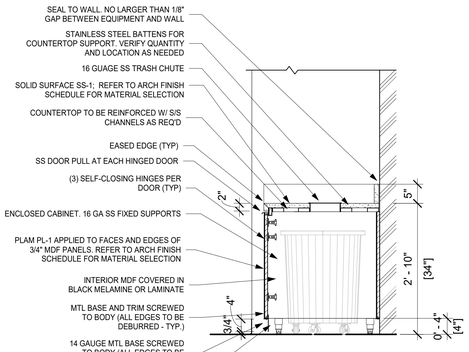


SOLID SURFACE SS-1; REFER TO ARCH FINISH SCHEDULE FOR MATERIAL SELECTION

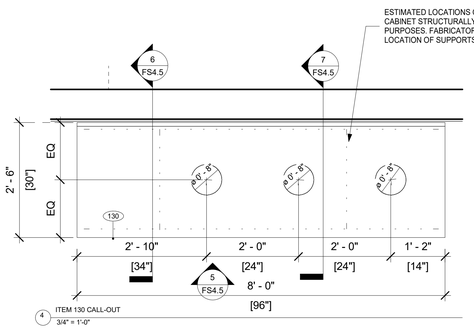
PLAM PL-1 APPLIED TO FACES AND EDGES OF 3/4" MDF PANELS. REFER TO ARCH FINISH SCHEDULE FOR MATERIAL SELECTION

MTL BASE AND TRIM. REFER TO ARCH FINISH SCHEDULE FOR MATERIAL SELECTION. SCREW AND USE ADHESIVE TO ATTACH TO MDF. SCREWS SHOULD NOT BE VISIBLE TO GUESTS

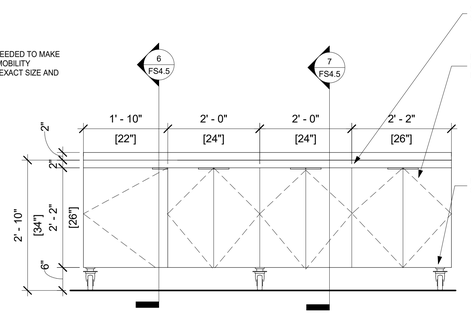
2 ITEM 63 ELEVATION
3/4" = 1'-0"



3 ITEM 63 SECTION
3/4" = 1'-0"



4 ITEM 130 CALL-OUT
3/4" = 1'-0"

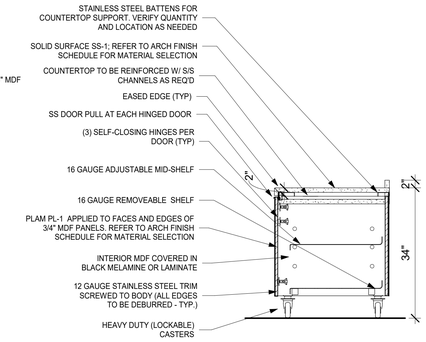


SOLID SURFACE SS-1; REFER TO ARCH FINISH SCHEDULE FOR MATERIAL SELECTION

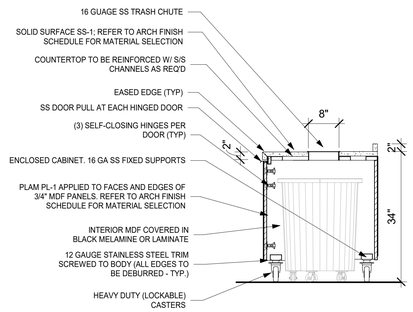
PLAM PL-1 APPLIED TO FACES AND EDGES OF 3/4" MDF PANELS. REFER TO ARCH FINISH SCHEDULE FOR MATERIAL SELECTION

FABRICATOR TO CONFIRM HOW MANY SETS OF CASTERS NEEDED FOR SUPPORT OF CABINET

5 ITEM 130 ELEVATION
3/4" = 1'-0"



6 ITEM 130 SECTION 1
3/4" = 1'-0"



7 ITEM 130 SECTION 2
3/4" = 1'-0"

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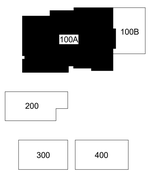
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023
ADDENDUM 03	03/15/2024



KEY PLAN

LSD SB-005
JOB 230538

N

SHEET TITLE
FOODSERVICE EQUIPMENT DETAILS

SHEET NO.
FS4.5

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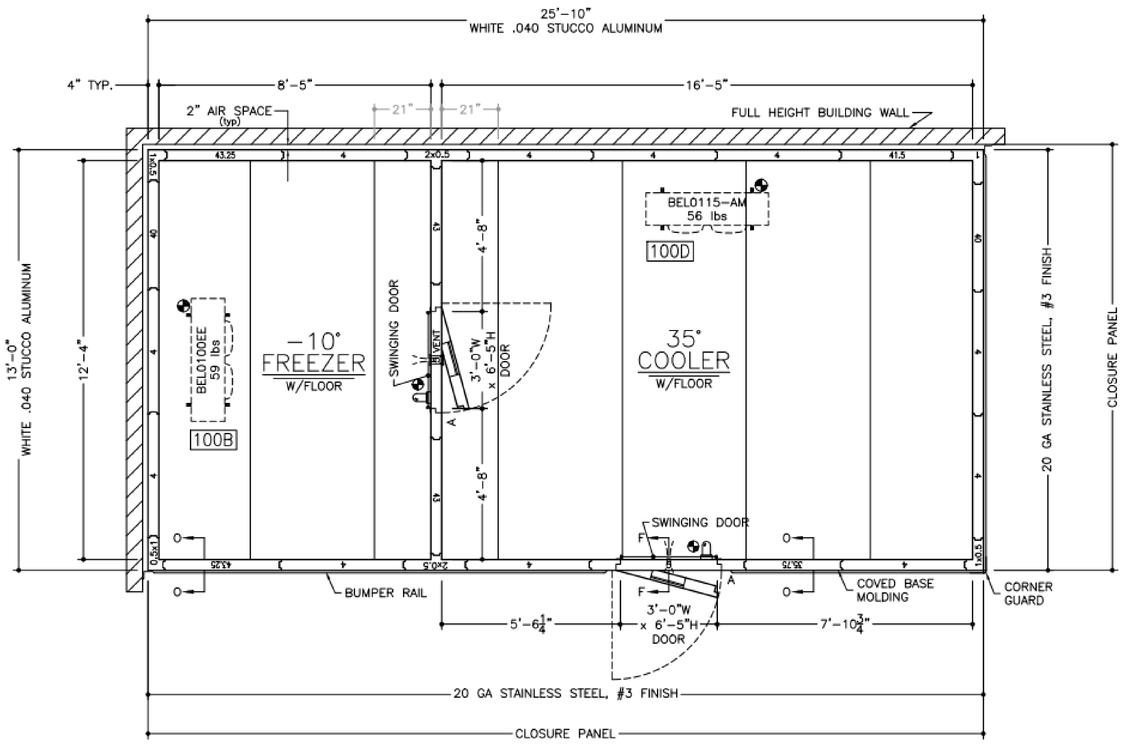

~SPECIFICATIONS~

BOX HEIGHT: FREEZER – 9'-2" OVERALL (8'-2" INTERIOR)
COOLER – 9'-2" OVERALL (8'-2" INTERIOR)

CONSTRUCTION: FOAMED IN PLACE
NSF LISTED, STANDARD NO. 7

INSULATION: 4" URETHANE, FINISHED PANEL
UL CLASSIFIED FLAME SPREAD 20
CORE SMOKE DEVELOPED 250

INSTALLATION: INDOOR

FLOOR: (SEE DETAILS) FREEZER – STANDARD
COOLER – STANDARD

DOOR HARDWARE & ACCESSORIES: (EACH DOOR)
POWER TO BE STUBBED OUT CEILING PANEL
DRY CONTACT LEADS TO BE STUBBED OUT CEILING PANEL IN A SEPARATE STUB OUT
DEADBOLT HANDLE W/KEYED CYLINDER LOCK, PADLOCK PROVISION & QUARTER TURN INSIDE RELEASE
1/8" STAINLESS STEEL THRESHOLD COVER PLATE
FRAME HEATER WIRE
HYDRAULIC DOOR CLOSER
IC+ WALK-IN DOOR CONTROLLER AND ALARM SYSTEM INCLUDING:
INTEGRATED LIGHT SWITCH WITH AUTOMATIC LIGHT OFF AND 3-WAY & 4-WAY CAPABILITY
TEMPERATURE MONITOR AND LOGGER WITH HIGH TEMP. AND LOW TEMP. VISUAL AND AUDIO ALARM
F OR C TEMPERATURE SELECTION
INTEGRATED DRY CONTACT FOR ALARM SIGNALING & POWER FAILURE (1A @ 24VAC, 1A @ 30VDC)
DOOR AND WINDOW HEATER CONTROL (WHEN SO EQUIPPED)
HACCP PREVIEW VIA ONBOARD LCD SCREEN
HACCP DOWNLOAD VIA USB
WIFI CONNECTIVITY (INTERNET ENABLED WIFI NETWORK NEEDED)
BATTERY BACKUP
TEMPERATURE ALARM NOTIFICATION VIA EMAIL &/OR EMAIL TO SMS TEXT MESSAGES
POWER FAILURE NOTIFICATION VIA EMAIL &/OR EMAIL TO SMS TEXT MESSAGES (FOR THIS FEATURE TO WORK THE LOCAL WIFI NETWORK MUST BE POWER PROTECTED AND WORKING AT THE TIME OF POWER FAILURE EVENT)
AUTOMATIC AND ON DEMAND TRANSMISSION OF HACCP DATA VIA EMAIL
ADAPTIVE SETTINGS
25' AIR TEMPERATURE PROBE
25' SECOND PROBE (EXTENDED) FOR MONITORING THE TEMPERATURE AT A SECOND LOCATION OR FOR MONITORING A SECOND CABINET (COOLER ONLY)
DOOR SWITCH TO ENABLE DOOR AJAR ALARM, DOOR AJAR NOTIFICATION VIA EMAIL &/OR EMAIL TO SMS TEXT MESSAGES, AND AUTOMATIC LIGHTS ON WHEN DOOR OPENS
PANIC ALARM WITH ILLUMINATED PANIC BUTTON, ALARM BUZZER WITH LED, & NOTIFICATION VIA EMAIL &/OR EMAIL TO SMS TEXT MESSAGES
KASON SCREW-IN VAPOR PROOF LIGHT FIXTURE W/8.5 WATT SYLVANIA LED BULB & GLOBE
CCI CLEAR VU SWINGING DOOR
3 – SPRING LOADED CAM RISE HINGES
HEATED VISION WINDOW (14" x 14")
1/8" DIAMOND ALUMINUM TREAD PLATE INTEGRAL KICKPLATES @ 36" HIGH I/S & O/S
KASON #1827 PRESSURE RELIEF VENT (FREEZER ONLY)

ACCESSORIES: (SHIPPED LOOSE)
VERIFY HEIGHT
2 – PCS. TRIM ANGLE – 20 GA STAINLESS STEEL, #3 FINISH
CLOSURE PANEL TO AN EXISTING CEILING (PER PLAN) – 20 GA STAINLESS STEEL, #3 FINISH
5 – 48" (1810LC) LED LIGHT FIXTURE(S) @ 40W EACH
1 – 1/8" DIAMOND ALUMINUM TREAD PLATE CORNER GUARD(S) @ 72" HIGH
20 GA STAINLESS STEEL COVED BASE MOLDING (EXPOSED EXTERIOR ONLY)
TWO TIER RIGID VINYL CHANNEL BUMPER RAIL (BOSTON SERIES 2000) W/VINYL INSERT @ 8" A.F.F. & @ 16" A.F.F. – GREY (PER PLAN)
2 – STAINLESS STEEL THERMOMETER PROBE STAND-OFF BRACKET(S)

METAL FINISHES:
INTERIOR & EXTERIOR DOOR & FRAME – 22 GA STAINLESS STEEL, #3 FINISH
INTERIOR WALLS & CEILING – 20 GA STAINLESS STEEL, #3 FINISH
EXPOSED EXTERIOR – 20 GA STAINLESS STEEL, #3 FINISH
UNEXPOSED EXTERIOR – WHITE .040 STUCCO ALUMINUM
EXTERIOR FLOOR & CEILING – 26 GA STUCCO ACRYLUME
INTERIOR FLOOR – 14 GA GALVANIZED STEEL (NOT NSF APPROVED IF EXPOSED)

REFRIGERATION:
U.L. LISTED, AIR COOLED, OUTDOORS

FREEZER ITEM 100A: CONDENSING UNIT: 1 – STD. PRE-ASSEMBLED REMOTE – HERMETIC SCROLL 2.60 HP MODEL NO. FFAL-A22Z-TFC-075 (R-448A) HEAT OF REJECTION: 13,369 BTUH'S
ITEM 100B: EVAPORATOR: 1 – MODEL NO. BEL0100BS6EE W/E.C. MOTORS & I.R.C.

COOLER ITEM 100C: CONDENSING UNIT: 1 – STD. PRE-ASSEMBLED REMOTE – HERMETIC SCROLL 1.75 HP MODEL NO. FFAP-A20Z-TFC-075 (R-448A) HEAT OF REJECTION: 17,680 BTUH'S
ITEM 100D: EVAPORATOR: 1 – MODEL NO. BEL0115BS6AM W/E.C. MOTORS & I.R.C.

REFRIGERATION ACCESSORIES:
2 – WINTERIZATION CONTROLS/LASA
2 – U.L. LISTED COMPRESSOR COVER(S) (HINGED)
2 – STAND(S) FOR U.L. COVER (18" HIGH)

NOTE: THE LARGEST WALK-IN PANEL ON THIS JOB IS 57.5" x 98".
NOTE: THE LARGEST WALK-IN PANEL ON THIS JOB IS 46" x 156". CUSTOMER IS TO VERIFY THAT THIS PANEL SIZE WILL NOT CONFLICT WITH ANY JOB SITE RESTRICTIONS.
NOTE: CUSTOMER IS TO VERIFY ALL DIMENSIONS, SECTIONS, DETAILS AND SPECIFICATIONS
NOTE: MAXIMUM LIGHT CIRCUIT LOAD IS 1200W 120VAC TUNGSTEN, 5A 120VAC ELECTRONIC BALLAST. FOR HIGHER LOADS ADDITIONAL LIGHT FIXTURES MUST BE CONTROLLED VIA RELAY (BY OTHERS).

COOLER	
DOOR FRAME KWHr/DAY	1.584
CONDENSING UNIT AWEF VALUE	7.6
EVAP AWEF VALUE	9.0

FREEZER	
DOOR FRAME KWHr/DAY	3.600
CONDENSING UNIT AWEF VALUE	3.15
EVAP AWEF VALUE	4.0

INSULATION R-VALUES		
PANEL TYPE	COOLER	FREEZER
4" WALLS, ROOFS	R-29	R-32
5" WALLS, ROOFS	R-36	R-40
FLOORS	R-25	R-28
DOORS	R-32	

WALK-IN PANEL		
R-8967		
BUILDING UNITS	R-8967	37M2
USA		
SURFACE BURNING CHARACTERISTICS		
MATERIAL DETAILS	"FLAME SPREAD"	"SMOKE DEVELOPED"
ALUMINUM PANELS, PAINTED OR UNPAINTED, 5" OR LESS	15	350
*GALVANIZED STEEL OR STAINLESS STEEL PANELS, PAINTED OR UNPAINTED, 5" OR LESS"	10	400 TO 500
CORE MATERIAL, 6" THICK	20	250

AMERICAN PANEL WALK-IN COOLERS AND FREEZERS COMPLY WITH THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC), SECTION C403.11

THIS AMERICAN PANEL WALK-IN WILL BE MANUFACTURED TO UL & NSF REQUIREMENTS. AMERICAN PANEL ACCEPTS NO LIABILITY FOR LOCAL CODE REQUIREMENTS OF WHICH AMERICAN PANEL HAS NOT BEEN MADE AWARE OF IN WRITING PRIOR TO FABRICATION.

ELECTRICAL DATA

= POINT OF ELECTRICAL CONNECTIONS.

	FREEZER		RUN LOAD AMPS	MCA
ITEM 100A	CONDENSING UNIT:	208-230v/60/3ø	10.9 AMPS	15.7 AMPS
ITEM 100B	EVAPORATOR:	208-230V/60/1ø	9.1 AMPS	1.0 AMPS
	COOLER		RUN LOAD AMPS	MCA
ITEM 100C	CONDENSING UNIT:	208-230v/60/3ø	9.7 AMPS	13.9 AMPS
ITEM 100D	EVAPORATOR:	115v/60/1ø	0.0 AMPS	1.0 AMPS
	WALK-IN DOORS:	115v/1ø – 350w*		

*NOTE: ADD WATTAGE FOR EACH ADDITIONAL LIGHT FIXTURE IN ACCESSORIES.

☐ APPROVED SIGNATURE _____
☐ APPROVED AS NOTED PRINT NAME _____
☐ REVISE & RESUBMIT DATE _____

ITEM #100, 100.1, 100.2, 100.3, 100.4

1) Please verify that door swing and location are correct.
2) If this walk-in is to be installed in a depression, or quarry tile is to be applied to the interior, depression depths or tile thickness must be specified to insure proper door height.
3) All site preparation, floor or slab construction, plumbing, electrical connections (including control wiring) by others.
4) Electrical: 115-60-1 required above latch side of each door, through ceiling, to operate frame heater and light.
5) Special note to General Contractor and his Sub Contractor for quarry tile or concrete wearing floors: the sheet metal panel facings may be susceptible to staining due to excessive moisture created by hydration of concrete type materials. Therefore, it is absolutely necessary that each room be properly ventilated. Also note that special precautions must be taken when using muriatic acid due to effects hydrochloric acid fumes have on aluminum and stainless steel.
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5600 S.E. 78th St. Ocala, Florida 34472
Ph. (352) 245-7055 Fax (352) 245-0726

CUSTOMER: THE BAKER GROUP
PROJECT: WILLOW SCHOOL – LANSING, MI
DATE: 10/05/23 | DRAWN BY: DMW/JS | P.O.#:
SCALE: 3/8"=1'-0" | PROPOSAL#: PD208428 | JOB#: | SHEET 1 of 2

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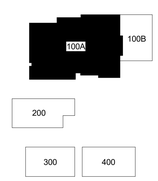
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023



KEY PLAN

LSD SB-005
JOB 230538
N

SHEET TITLE: FOODSERVICE WALK-IN DETAILS

SHEET NO. FS5.1

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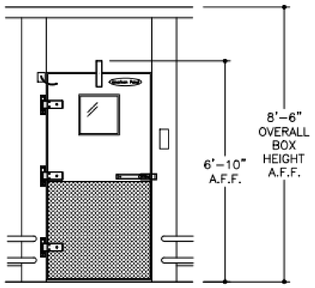
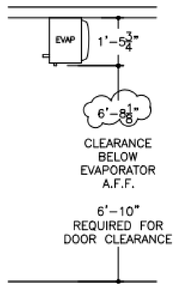
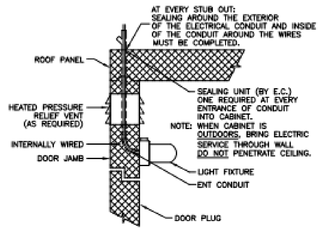


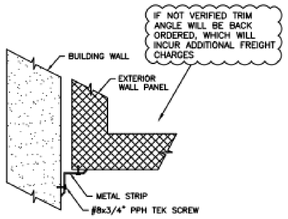
COOLER DOOR ELEVATION



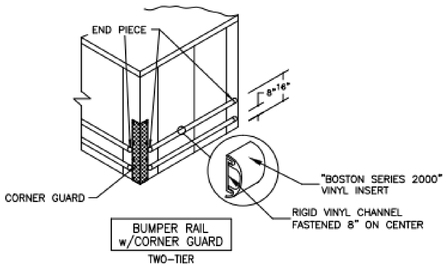
SECTION AT EVAPORATOR
TYP.



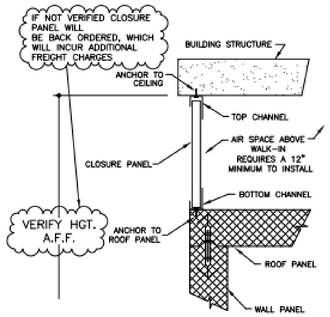
DOOR ELECTRICAL CONNECTION



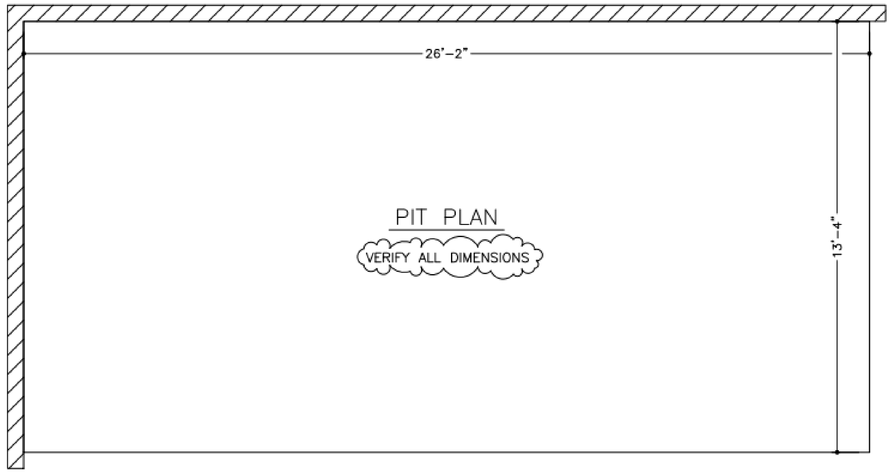
TRIM ANGLE
DETAIL #2



BUMPER RAIL
w/CORNER GUARD
TWO-TIER

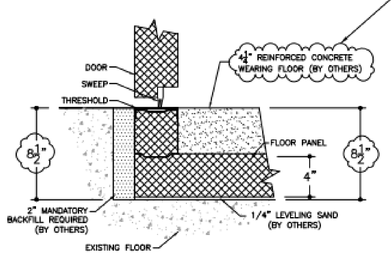


CLOSURE PANEL

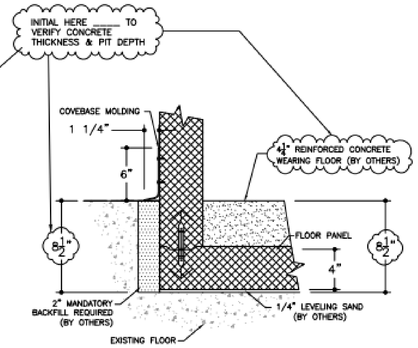


PIT PLAN

VERIFY ALL DIMENSIONS



SECTION F – F



SECTION O – O

To prevent metal corrosion, doors must be kept open and air circulating during application and curing of all flooring materials including concrete, grout, epoxy, etc.

☐ APPROVED
☐ APPROVED AS NOTED
☐ REVISE & RESUBMIT

SIGNATURE _____
PRINT NAME _____
DATE _____

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CUSTOMER: THE BAKER GROUP			
PROJECT: WILLOW SCHOOL – LANSING, MI			
DATE: 10/05/23	DRAWN BY: DMW/JS	P.O.#:	
SCALE: 3/8"=1'-0"	PROPOSAL#: PD208428	JOB#:	SHEET 2 of 2

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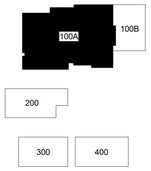

KEY PLAN

LSD SB-005
JOB 230538

N

SHEET TITLE
FOODSERVICE WALK-IN DETAILS

SHEET NO.
FS5.2

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Michigan Office
REGION 77
PHONE: (616) 942 - 9881
EMAIL: reg77@captiveaire.com

PATENT NUMBERS

AC-PSP (UNITED STATES) - US PATENT 7963830 B2.
AC-PSP WALL (CANADA) - CA PATENT 2820509.
AC-PSP ISLAND (CANADA) - CA PATENT 2520330.

HOOD INFORMATION – JOB#6214394

HOOD NO	TAG	MODEL	MANUFACTURER	LENGTH	MAX COOKING TEMP	TYPE	APPLIANCE DUTY	DESIGN CFM/FT	TOTAL EXH CFM	EXHAUST PLENUM RISER(S) WIDTH	LENG	HEIGHT	DIA	CFM	VEL	SP	TOTAL SUPPLY CFM	HOOD CONSTRUCTION	HOOD CONFIG END TO END	ROW
1	15	6024 ND-2-PSP-F	CAPTIVEAIRE	11' 0"	600 DEG	I	HEAVY	200	2200			4"	16"	2200	1576	-0.689"	1760	430 SS 100%	ALONE	ALONE

HOOD INFORMATION

HOOD NO	TAG	FILTER(S) TYPE	QTY	HEIGHT	LENGTH	EFFICIENCY @ 7 MICRONS	LIGHT(S) QTY	TYPE	WIRE GUARD	UTILITY CABINET(S) LOCATION	SIZE	FIRE SYSTEM TYPE	SIZE	ELECTRICAL MODEL #	SWITCHES QUANTITY	FIRE SYSTEM PIPING	HOOD HANGING WEIGHT
1	15	CAPTRATE SOLO FILTER	8	20"	16"	85% SEE FILTER SPEC	4	RECESSED ROUND	NO							YES	624 LBS

HOOD OPTIONS

HOOD NO	TAG	OPTION
1	15	FIELD WRAPPER 18.00" HIGH FRONT, LEFT, RIGHT.
		BACKSPLASH 80.00" HIGH X 134.00" LONG 430 SS VERTICAL.
		LEFT SIDESPLASH 80.00" HIGH X 60.00" LONG 430 SS VERTICAL.
		RIGHT SIDESPLASH 80.00" HIGH X 60.00" LONG 430 SS VERTICAL.
		RIGHT END STANDOFF (FINISHED) 1" WIDE 60" LONG INSULATED.
		LEFT END STANDOFF (FINISHED) 1" WIDE 60" LONG INSULATED.
		STRUCTURAL FRONT PANEL.
		RIGHT WALL AS END PANEL.
		LEFT WALL AS END PANEL.

PERFORATED SUPPLY PLENUM(S)

HOOD NO	TAG	POS	LENGTH	WIDTH	HEIGHT	TYPE	RISER(S) WIDTH	LENG	DIA	CFM	SP
1	15	Front	134"	14"	6"	MUA	10"	24"		586	0.186"
						MUA	10"	24"		586	0.186"
						MUA	10"	24"		586	0.186"

WALL-MOUNT UTILITY CABINET

HOOD NO	LOCATION	SIZE	UTILITY CABINET(S) FIRE SYSTEM TYPE	SIZE	ELECTRICAL MODEL #	SWITCHES QUANTITY	WEIGHT
1	WALL MNT	12"x48"x24"	TANK FS	4.0/4.0	DCV-1111	1 LIGHT 1 FAN	340.00 LBS

GREASE DUCT & CHIMNEY SPECIFICATIONS:
PROVIDE GREASE DUCT EQUAL TO CAPTIVEAIRE SYSTEMS MODEL "DW" ROUND 20 GAUGE 430 STAINLESS STEEL DUCTWORK. MODEL "DW" IS LISTED TO UL-1978 AND IS INSTALLED USING "V" CLAMP LOCKING CONNECTIONS SEALED WITH 3M FIRE BARRIER 2000 PLUS. MODEL "DW" DOES NOT REQUIRE WELDING PROVIDING IT HAS BEEN INSTALLED PER THE MANUFACTURES INSTALLATION GUIDE.
PROVIDE RATED ACCESS DOORS AT EVERY CHANGE IN DIRECTION AND EVERY 12' ON CENTER. PER MANUFACTURES LISTING MODEL "DW" HORIZONTAL RUNS LESS THAN 75 FT. CAN BE SLOPED 1/16" PER 12", HORIZONTAL RUNS MORE THAN 75 FT. CAN BE SLOPED 3/16" PER 12". DUCT SHOULD BE SLOPED AS MUCH AS POSSIBLE TO REDUCE THE CHANCE OF GREASE ACCUMULATION IN HORIZONTAL RUNS.

IF THE DUCT OR CHIMNEY IS WITHIN 18 INCHES OF COMBUSTIBLE MATERIAL, PROVIDE UL-2221 OR UL-103 HT LISTED DOUBLE WALL GREASE DUCT OR DOUBLE WALL CHIMNEY EQUAL TO CAPTIVEAIRE SYSTEMS MODEL "DW- 2R, 2R TYPE HT, 3R, OR 3Z" ROUND 20 GAUGE 430 STAINLESS INNER DUCT INSULATED WITH A 24 GAUGE 430 STAINLESS OUTER SHELL.

CAPTIVEAIRE SYSTEMS RECOMMENDS THE USE OF LISTED, PRE-FABRICATED ROUND GREASE EXHAUST DUCT TO REDUCE STATIC PRESSURE IN THE SYSTEM, MINIMIZE INSTALLATION AND INSPECTION TIMES, AND ENSURE DUCT IS LIQUID TIGHT

HVAC DISTRIBUTION NOTE

HIGH VELOCITY DIFFUSERS OR HVAC RETURNS SHOULD NOT BE PLACED WITHIN TEN (10) FEET OF THE EXHAUST HOOD. PERFORATED DIFFUSERS ARE RECOMMENDED.

VERIFY CEILING HEIGHT

___' - ___"

HEIGHT REQUIRED TO VERIFY THAT HOOD FITS SPACE AND TO SIZE THE ENCLOSURE PANELS

CUSTOMER APPROVAL TO MANUFACTURE:

APPROVED AS NOTED ☐
APPROVED WITH NO EXCEPTION TAKEN ☐
REVISE AND RESUBMIT ☐
SIGNATURE _____
YOUR TITLE _____ DATE _____

SPECIFICATION: CAPTRATE• GREASE-STOP• SOLO FILTER

THE CAPTRATE GREASE-STOP SOLO FILTER IS A SINGLE-STAGE FILTER FEATURING A UNIQUE S-BAFFLE DESIGN IN CONJUNCTION WITH A SLOTTED REAR BAFFLE DESIGN, TO DELIVER EXCEPTIONAL FILTRATION EFFICIENCY.

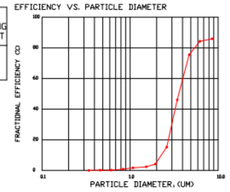
FILTER IS STAINLESS STEEL CONSTRUCTION, AND SIZED TO FIT INTO STANDARD 2-INCH DEEP HOOD CHANNEL(S).

UNITS SHALL INCLUDE STAINLESS STEEL HANDLES AND A FASTENING DEVICE TO SECURE THE TWO COMPONENTS WHEN ASSEMBLED.

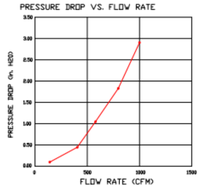
GREASE EXTRACTION EFFICIENCY PERFORMANCE SHALL REMOVE AT LEAST 75% OF GREASE PARTICLES FIVE MICRONS IN SIZE, AND 85% GREASE PARTICLES SEVEN MICRONS IN SIZE AND LARGER, WITH A CORRESPONDING PRESSURE DROP NOT TO EXCEED 1.0 INCHES OF WATER GAUGE.

THE CAPTRATE GREASE-STOP SOLO WAS TESTED TO ASTM STANDARD ASTM F2519-05.
MANUFACTURER APPROVED FOR USE IN SOLID FUEL APPLICATIONS AS A SPARK ARRESTER.

EFFICIENCY VS. PARTICLE DIAMETER



PRESSURE DROP VS. FLOW RATE



CAPTRATE FILTERS ARE BUILT IN COMPLIANCE WITH:
NFPA #96.
NSF STANDARD #2.
UL STANDARD #1046.
INT. MECH. CODE (IMC).
ULC-S649.

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Willow School Lansing
1012 W. Willow,
Lansing, MI 48915

DATE: 9/11/2023
DWG.#: 6214394
DRAWN BY: RJF
SCALE: 3/4" = 1'-0"
MASTER DRAWING
SHEET NO. 1

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Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
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KEY PLAN

LSD SB-005
JOB 230538
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SHEET TITLE
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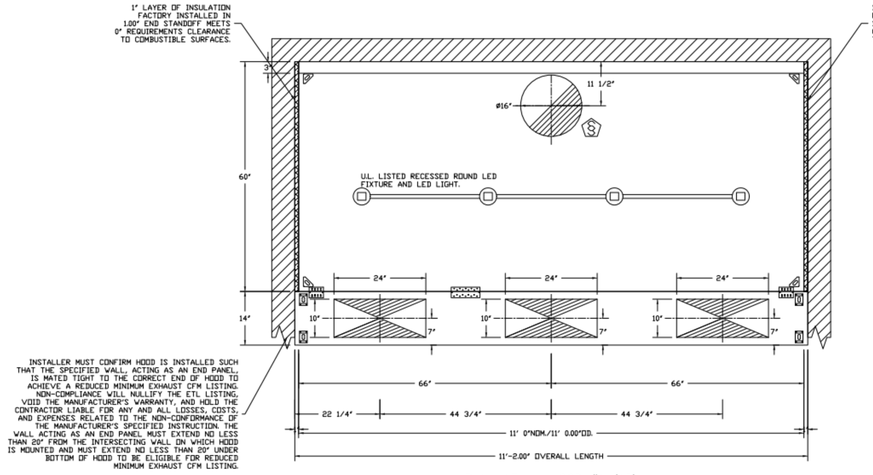
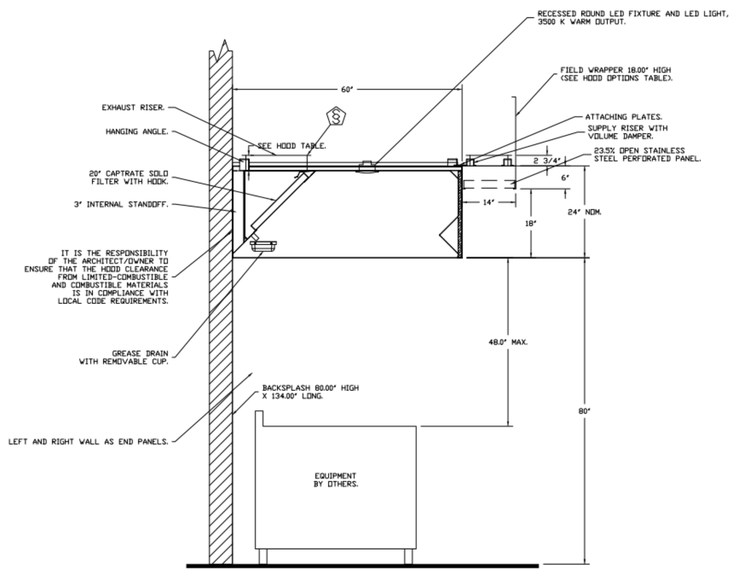
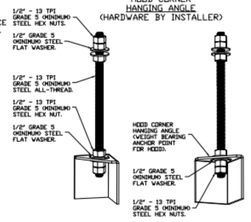


PLAN VIEW – HOOD #1 (15)
11' 0.00" LONG 6024ND-2-PSP-F



SECTION VIEW – MODEL 6024ND-2-PSP-F
HOOD – #1 (15)

HOOD CORNER
HANGING ANGLE
(HARDWARE BY INSTALLER)



ASSEMBLY INSTRUCTIONS

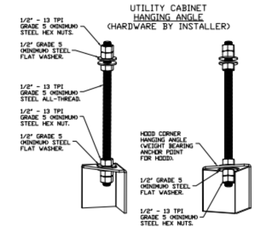
HANGING ANGLE MUST BE SUPPORTED WITH 1/2" - 13 TPI GRADE 5 (MINIMUM) ALL-THREAD. SANDWICH HANGING ANGLES AND CEILING ANCHOR POINTS WITH 1/2" GRADE 5 (MINIMUM) STEEL FLAT WASHERS AND 1/2" - 13 TPI GRADE 5 (MINIMUM) HEX NUTS AS SHOWN. MUST USE DOUBLED HEX NUT CONFIGURATION BENEATH HOOD HANGING ANGLES AND ABOVE CEILING ANCHORS. MAINTAIN 1/4" OF EXPOSED THREADS BENEATH BOTTOM HEX NUT. TORQUE ALL HEX NUTS TO 57 FT-LBS.

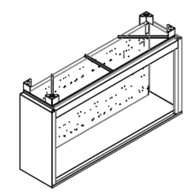
WALL-MOUNT UTILITY CABINET
ASSEMBLY INSTRUCTIONS

HANGING ANGLE MUST BE SUPPORTED WITH 1/2" - 13 TPI GRADE 5 (MINIMUM) ALL-THREAD. SANDWICH HANGING ANGLES AND CEILING ANCHOR POINTS WITH 1/2" GRADE 5 (MINIMUM) STEEL FLAT WASHERS AND 1/2" - 13 TPI GRADE 5 (MINIMUM) HEX NUTS AS SHOWN. MUST USE DOUBLED HEX NUT CONFIGURATION BENEATH UTILITY CABINET HANGING ANGLES AND ABOVE CEILING ANCHORS. MAINTAIN 1/4" OF EXPOSED THREADS BENEATH BOTTOM HEX NUT. TORQUE ALL HEX NUTS TO 57 FT-LBS.

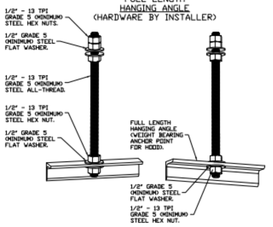
CABINET TO BE HUNG BY HOOD INSTALLER. SEE UTILITY CABINET SCHEDULE FOR CABINET SIZE.

UTILITY CABINET
HANGING ANGLE
(HARDWARE BY INSTALLER)





FULL LENGTH
HANGING ANGLE
(HARDWARE BY INSTALLER)



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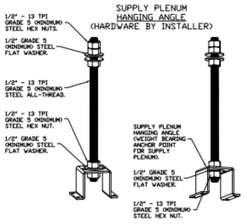
SUPPLY PLENUM
HANGING ANGLE
(HARDWARE BY INSTALLER)



ASSEMBLY INSTRUCTIONS

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REVISIONS

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Willow School Lansing
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DATE: 9/11/2023

DWG.#: 6214394

DRAWN BY: RJF

SCALE: 3/4" = 1'-0"

MASTER DRAWING

SHEET NO. 2

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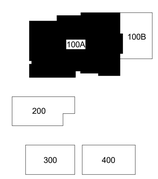

KEY PLAN

LSD SB-005
JOB 230538

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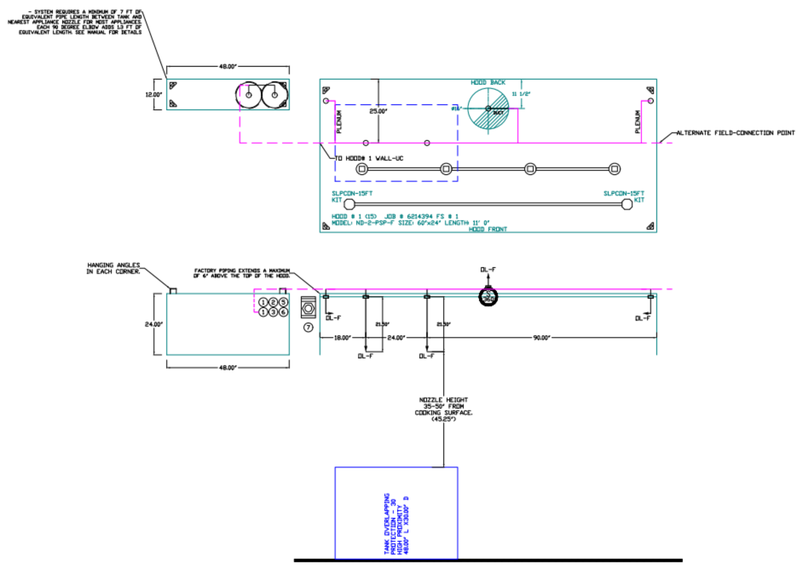


NOTES
- FIELD PIPE DROPS AS SHOWN
- PIPING, ELBOWS, TEES, AND NOZZLES SUPPLIED BY CAS.
- FIELD INSTALLED DROP: FACTORY WILL PROVIDE QTY 2 60IN LONG PIECES OF CHROME PLATED PIPING SHIPPED LOOSE TO BE FIELD-INSTALLED.
- SHIP LOOSE DROP: FACTORY WILL PROVIDE THE EXACT CHROME PIPE LENGTH NEEDED SHIPPED LOOSE TO BE FIELD-INSTALLED.
- RELOCATE NOZZLES IF FLOW PATTERN IS BLOCKED BY SHELVING, SALAMANDERS, ETC.
- OVERLAPPING COVERAGE SHALL NOT BE USED ON ANY APPLIANCE WITH AN OBSTRUCTION.
- IF APPLICABLE, EXTENDED PRE-PIPED DROPS ARE SHIPPED LOOSE.
- FACTORY PIPING EXTENDS A MAXIMUM OF 6" ABOVE THE TOP OF THE HOOD.

- APPLIANCE DIMENSIONS LISTED REPRESENT THE COOKING SURFACE SIZE, NOT THE OVERALL APPLIANCE SIZE.

- THIS FIRE SYSTEM COMPLIES WITH UL. 300 REQUIREMENTS.

- DL-F NOZZLE PART NUMBER REPLACES 3070-3/8H-10-SS

JOB #: 6214394.
JOB NAME: WILLOW SCHOOL LANSING.

SYSTEM SIZE: TANK-SP-2-WC TOTAL FP REQUIRED: 22.
HOOD # 1, 11' 0.00" LONG x 60" WIDE x 24" HIGH.
RISER # 1 SIZE: 16" DIA.
HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.

- HEAVY-DUTY APPLIANCES (RATED 600°F) WILL REQUIRE AN ADDITIONAL DOWNSTREAM FIRESTAT IN THE EVENT THAT THE DUCTWORK CONTAINS ANY HORIZONTAL RUNS OVER 25 FT IN LENGTH.
- MEDIUM TO LIGHT-DUTY APPLIANCES (RATED 450°F) WILL NOT REQUIRE ANY ADDITIONAL DOWNSTREAM DETECTION.

LEGEND - FIRE CABINET TANK SYSTEM

1 4 GALLON TANK.
2 PRIMARY ACTUATOR RELEASE.
3 SECONDARY ACTUATOR RELEASE.
4 PRESSURE SUPERVISION SWITCH.
5 PRIMARY HOSE ASSEMBLY.
6 SECONDARY HOSE ASSEMBLY.
7 REMOTE MANUAL ACTUATION DEVICE.

FIRE SYSTEM INFORMATION - JOB#6214394

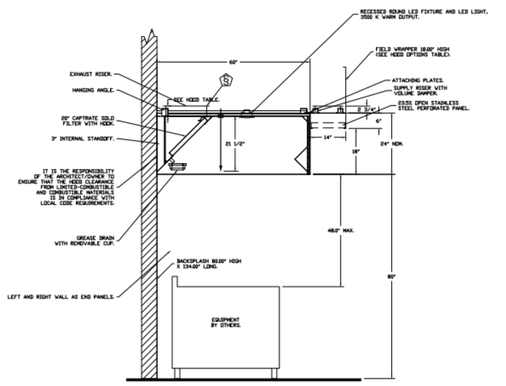
FIRE SYSTEM NO	TAG	TYPE	SIZE	FLOW POINTS	INSTALLATION	
					SYSTEM	LOCATION ON HOOD
1	16	TANK FS	4.0/4.0	22	WALL UTILITY CABINET LEFT	N/A

GAS VALVE(S)

FIRE SYSTEM NO	TAG	TYPE	SIZE	SUPPLIED BY
1	16	SC ELECTRICAL	2.000	CAPTIVEAIRE SYSTEMS

FIRE SYSTEM PARTS LIST KEY

FIRE SYSTEM NO	TAG	KEY NUMBER - PART DESCRIPTION	QTY BY FACTORY	QTY BY DIST
1	16	0 - 0 - TANK FIRE SUPPRESSION POST-DISCHARGE PROCEDURE UTILITY CABINET LABEL SHEET.	1	0
		0 - 0 - TANK FIRE SUPPRESSION MAINTENANCE GUIDE UTILITY CABINET LABEL SHEET.	1	0
		0 - 0 - 12-F28021-30144-017-360 DUCT FIRE THERMOSTAT WITH 12 FOOT WIRE LEADS. NO, CLOSE ON TEMP RISE AT 360°F.	1	0
		0 - 0 - 360391 3/8" BRASS PLUG.	3	0
		0 - 0 - 442903S3 1/2" MALE NPT TO 1/2" FEMALE NPT ELBOW, BRASS.	2	0
		0 - 0 - 442904G2 1/2" X 1/4" BRASS REDUCING BUSHING.	1	0
		0 - 0 - 79425 3/8" NPT FEMALE TO 1/2" MALE PROPRESS ADAPTER.	3	0
		0 - 0 - 79525 1/2" 90 PRO-PRESS ELBOW WITH 1/2 NPT FEMALE CONNECTION. VIEGA.	1	0
		0 - 0 - 79580 1/2" X 1/2" PRO-PRESS TEE X 1/2" NPT FEMALE CONNECTION. VIEGA.	2	0
		0 - 0 - 87-100040-001 SECONDARY ACTUATOR VALVE (SVA) - SINGLE ACTUATOR, REQUIRES PRIMARY RELEASE ACTUATOR. TANK FIRE SUPPRESSION.	1	0
		0 - 0 - 87-120045-001 HOSE, SECONDARY ACTUATOR HOSE, 7.5" BRAIDED STAINLESS STEEL. TANK FIRE SUPPRESSION.	1	0
		0 - 0 - 87-30001-001 TANK - PRESSURIZED TANK USED FOR TANK FIRE SUPPRESSION.	2	0
		0 - 0 - 87-300030-001 PRIMARY ACTUATOR KIT (PAK) - ACTUATOR AND RELEASE SOLENOID ASSEMBLY, ONE NEEDED PER FIRE SYSTEM. SUPERVISED. TANK FIRE SUPPRESSION.	1	0
		0 - 0 - 87-30032-001 HARDWARE, SVA BOLTS. TANK FIRE SUPPRESSION.	8	0
		0 - 0 - 9055455PC PRO PRESS 1/2 PRESS X PRESS 90 ELBOW LB.	5	0
		0 - 0 - 9097200PC PRO PRESS PC611 1/2 PRESS TEE LB.	5	0
		0 - 0 - 986144115 HARDWARE, DATANKLOCK LOCKING BRACKET SQUARE NUTS 5/16" ZINC. TANK FIRE SUPPRESSION.	4	0
		0 - 0 - A0034332 JUNCTION BOX FOR MANUAL PULL STATION. 15" DEEP BACK BOX, RED COLOR.	1	0
		0 - 0 - A30484 1/4" NPT SCHRADER VALVE AND CAP. .8 INDUSTRIES. 1/4" FLARE X 1/4" NPT HALF UNION. USED ON TANK SERVICE PORT.	1	0
		0 - 0 - B1145 3/8" BLACK IRON 90 ELL.	3	0
		0 - 0 - DATANKLOCK DISCHARGE ADAPTER TANK LOCKING PLATE FOR FIRE SYSTEM TANK INSTALLATION IN UTILITY CABINETS. TANK FIRE SUPPRESSION.	2	0
		0 - 0 - SLPCON-15FT SUPERVISED LOOP CONNECTION KIT. CONTAINS THE PARTS NEEDED TO CONNECT THE SUPERVISED LOOP BETWEEN END TO END HOODS WITH LESS THAN A 14" GAP OR BACK TO BACK HOODS. KIT CONTAINS 17 FEET OF BLACK TRC WIRE. 17 FEET OF TAN MC WIRE. 15 FEET OF FLEXIBLE CONDUIT, AND TWO 7/8" CONNECTORS.	2	0
		0 - 0 - TANK STRAP TANK STRAP - USED FOR TANK FIRE SUPPRESSION.	6	0
		0 - 0 - TFS-UCTANKBRACKET TANK BRACKET FOR FIRE SYSTEM TANK INSTALLATION IN UTILITY CABINETS. TANK FIRE SUPPRESSION.	2	0
		0 - 0 - WK-283952-000 DISCHARGE ADAPTER, TANK FIRE SUPPRESSION.	2	0
		16 - 16 - 79210 1/2" X 3/8" NPT MALE ADAPTER. VIEGA.	5	0
		16 - 16 - QL-F NOZZLE - TANK PROTECTION APPLIANCE COVERAGE NOZZLE (INCLUDES METAL BLOW OFF CAP, LANYARD, USED WITH CHROME-PLATED PIPE).	5	0
		26 - 26 - GSX-3/8 QUIK SEAL - 3/8" GLS.	5	0
		34 - 34 - A0034331 24V3C SINGLE ACTION MANUAL ACTUATION DEVICE (PUSH/PULL STATION) WITH PROTECTIVE COVER, ONE (1) NORMALLY OPEN CONTACT. RED COLOR.	1	0



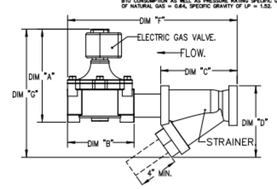
SECTION VIEW - MODEL 6024ND-2-PSP-F HOOD - #1

GAS VALVES AND STRAINERS

	GAS VALVE SIZING						GAS VALVE DIMENSIONS						INSTALLATION	PART NUMBERS		
	TYPE	SIZE	VOLTAGE	MIN. INLET PRESSURE	MAX. INLET PRESSURE	FLOW AT 1 IN.W.C. DROP NATURAL GAS	FLOW AT 1 IN.W.C. DROP PROPANE	DIM "A"	DIM "B"	DIM "C"	DIM "D"	DIM "F"	DIM "G"	MOUNTING ORIENTATION	GAS VALVE PART NUMBER	STRAINER PART NUMBER	GAS VALVE/STRAINER KIT
GAS VALVE FOR FS#—	ELECTRICAL	2"	120 VAC	PRESSURE: 0 PSI (0 IN.W.C.)	PRESSURE: 5 PSI (138 IN.W.C.)	2,940,000 BTU/HR	1,808,048 BTU/HR	7-5/8"	6-3/8"	7-1/4"	7-13-16"	10-5/8"	13-15/16"	HORIZONTAL/ VERTICAL	8214280	4417688	(SC)(C)VA2

ALL GAS VALVES/STRAINERS
PROPER CLEARANCE MUST BE PROVIDED IN ORDER TO SERVICE THE STRAINERS A MINIMUM OF 4" CLEARANCE DISTANCE MUST BE PROVIDED AT THE BASE OF THE STRAINER CUSTOMER MUST VERIFY BTU CONSUMPTION AS WELL AS PRESSURE RATING SPECIFIC GRAVITY OF NATURAL GAS = 0.64, SPECIFIC GRAVITY OF LP = 1.52.

CALCULATIONS
TO CALCULATE GAS FLOW FOR OTHER THAN 1 IN.W.C. PRESSURE DROP
NEW BTU/HR = (BTU/HR AT 1 IN.W.C. PRESSURE DROP) X NEW PRESSURE DROP$^{0.54}$
TO CALCULATE GAS FLOW FOR OTHER THAN 0.64 SPECIFIC GRAVITY
NEW BTU/HR = (BTU/HR AT 0.64) X (0.64 / NEW SPECIFIC GRAVITY)$^{0.5}$.



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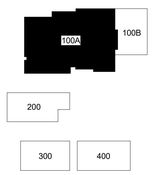

KEY PLAN

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SHEET TITLE FOODSERVICE VENTILATION DETAILS

SHEET NO. FS6.3

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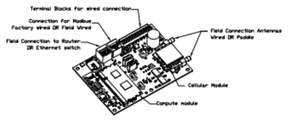
ELECTRICAL PACKAGE – JOB#6214394

NO	TAG	PACKAGE #	LOCATION	SWITCHES LOCATION	SWITCHES QUANTITY	OPTION	FANS CONTROLLED TYPE	#	HP	VOLT	FLA
1	15.1/15.2	DCV-1111	WALL UTILITY CABINET LEFT	SHIP LOOSE W/ PREWIRE	1 LIGHT 1 FAN	SMART CONTROLS DCV	EXHAUST	3	3.000	208	10.2
							SUPPLY	3	3.000	208	10.2



CASlink Monitor and Control

- Hood control panel to support communications to cloud-based Building Management System.
- Hood Control Panel to allow cloud-based Building Management System to monitor real time parameters outlined as MONITOR in the points list.
- Hood Control Panel to allow cloud-based Building Management System to control parameters outlined as CONTROL in the points list.
- Hood Control Panel to allow cloud-based Building Management System to implement SYSTEM ECONOMIZER control strategies for fully integrated Building Management.

MONITORING AND CONTROL POINTS LIST

DCV Package	Function
Room Temperature	MONITOR
Duct Temperature(s)	MONITOR
MUA Discharge Temperature	MONITOR
Kitchen RTU Discharge Temperature	MONITOR
Fan Speed	MONITOR
Fan Amperage	MONITOR
Fan Power	MONITOR
VFD Faults	MONITOR
Controller Faults	MONITOR
Fan Faults	MONITOR
FCU Faults	MONITOR
FCU Filter Clog Percentages	MONITOR
Fire Condition	MONITOR
CORE Fire System	MONITOR
Building Pressures	MONITOR
Prep Time Button	MONITOR & CONTROL
Fans Button	MONITOR & CONTROL
Lights Button	MONITOR & CONTROL
Wash Button	MONITOR & CONTROL

DC Package	Function
Room Temperature(s)	MONITOR
Duct Temperature(s)	MONITOR
MUA Discharge Temperature	MONITOR
Kitchen RTU Discharge Temperature	MONITOR
Controller Faults	MONITOR
Fan Faults	MONITOR
FCU Faults	MONITOR
FCU Filter Clog Percentages	MONITOR
Fire Condition	MONITOR
CORE Fire System	MONITOR
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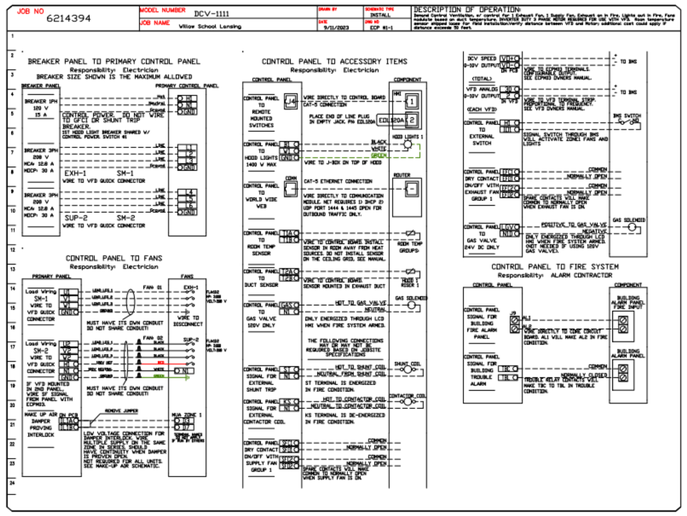
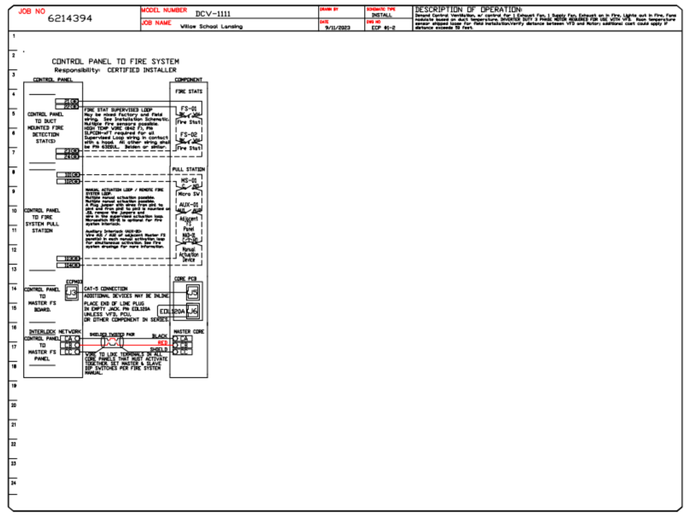
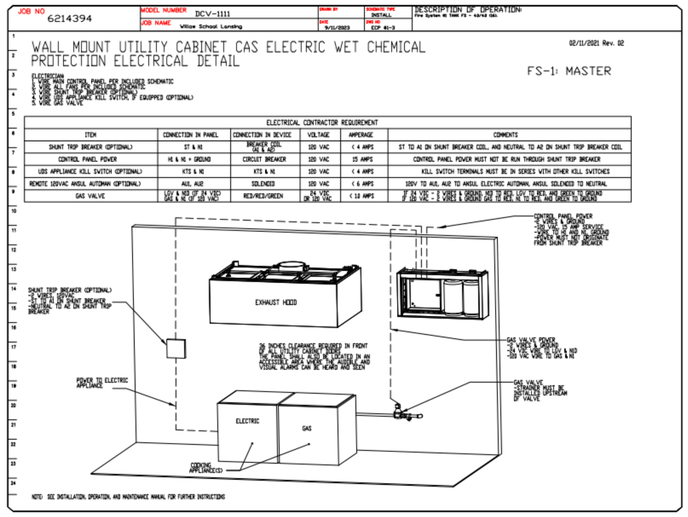
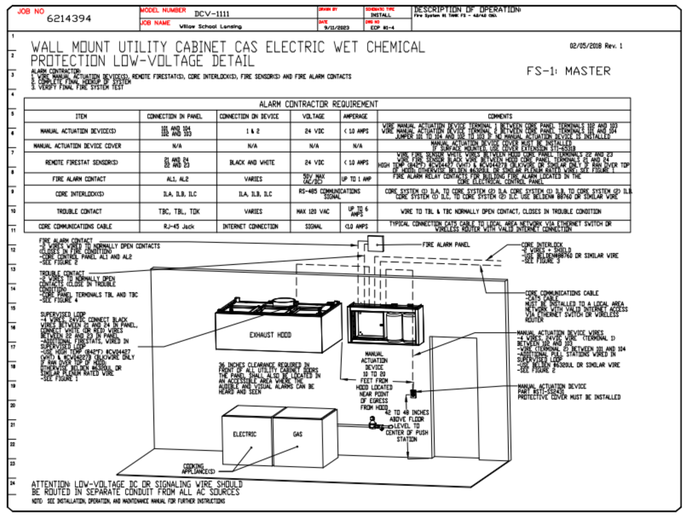
Lights Button(s)	MONITOR & CONTROL
Wash Button	MONITOR & CONTROL









REVISIONS

DESCRIPTION	DATE

CAPTIVEAIRE
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Michigan Office
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Willow School Lansing
1012 W. Willow,
Lansing, MI, 48915

DATE: 9/11/2023

DWG.#: 6214394

DRAWN BY: RJF

SCALE: 3/4" = 1'-0"

MASTER DRAWING

SHEET NO. 4

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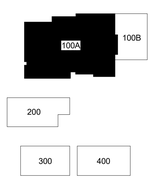
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023



KEY PLAN

LSD SB-005
JOB 230538

N

SHEET TITLE
FOODSERVICE VENTILATION DETAILS

SHEET NO.
FS6.4

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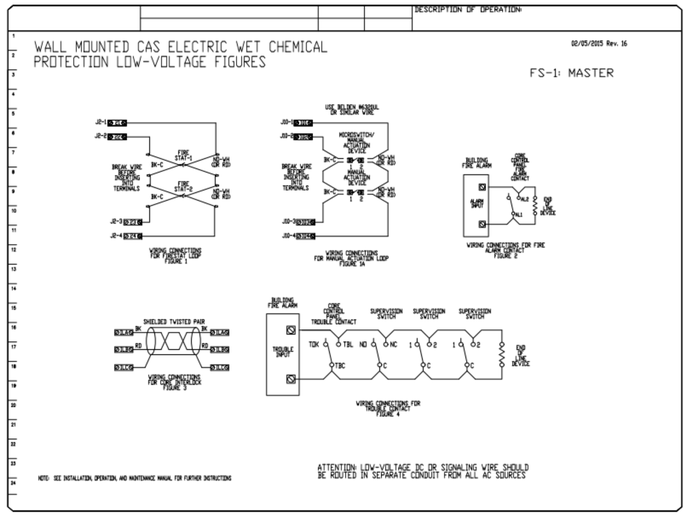
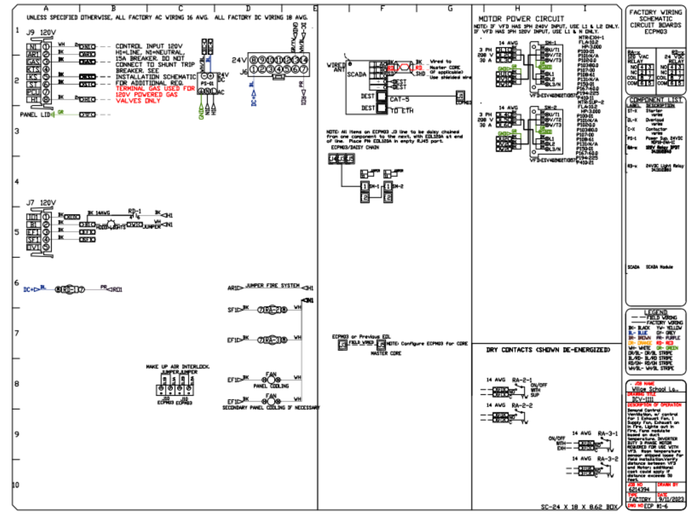
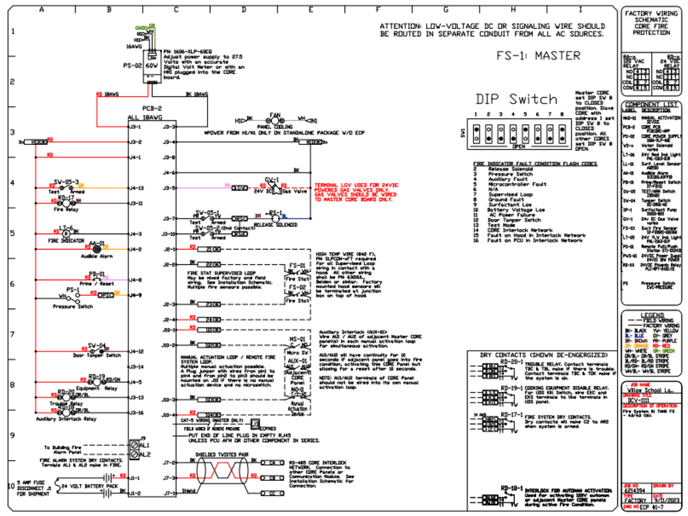
Autodesk Docs://Willow School Lansing Schools/Willow School FS.rvt

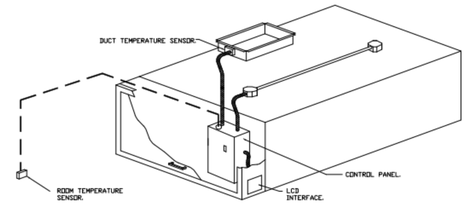






DEMAND CONTROL VENTILATION HOOD CONTROL PANEL SPECIFICATIONS:

- CONTROLS SHALL BE LISTED BY ETL (UL 508A) AND SHALL COMPLY WITH DEMAND VENTILATION SYSTEM TURNDOWN REQUIREMENTS OUTLINED IN IECC 403.7.5 (2021).
- THE CONTROL ENCLOSURE SHALL BE NEMA 1 RATED AND LISTED FOR INSTALLATION INSIDE OF THE EXHAUST HOOD UTILITY CABINET. THE CONTROL ENCLOSURE MAY BE CONSTRUCTED OF STAINLESS STEEL OR PAINTED STEEL.
- TEMPERATURE PROBE(S) LOCATED IN THE EXHAUST DUCT RISER(S) SHALL BE CONSTRUCTED OF STAINLESS STEEL.
- A DIGITAL CONTROLLER SHALL BE PROVIDED TO ACTIVATE THE HOOD EXHAUST FANS DYNAMICALLY BASED ON A FIXED DIFFERENTIAL BETWEEN THE AMBIENT AND DUCT TEMPERATURES SENSORS. THIS FUNCTION SHALL MEET THE REQUIREMENTS OF IMC 507.1.i.
- A DIGITAL CONTROLLER SHALL PROVIDE ADJUSTABLE HYSTERESIS SETTINGS TO PREVENT CYCLING OF THE FANS AFTER THE COOKING APPLIANCES HAVE BEEN TURNED OFF AND/OR THE HEAT IN THE EXHAUST SYSTEM IS REDUCED.
- A DIGITAL CONTROLLER SHALL PROVIDE AN ADJUSTABLE MINIMUM FAN RUN-TIME SETTING TO PREVENT FAN CYCLING.
- VARIABLE FREQUENCY DRIVES (VFDS) SHALL BE PROVIDED FOR FANS AS REQUIRED. THE DIGITAL CONTROLLER SHALL MODULATE THE VFDS BETWEEN A MINIMUM SETPOINT AND A MAXIMUM SETPOINT ON DEMAND. THE DUCT TEMPERATURE SENSOR INPUT(S) TO THE DIGITAL CONTROLLER SHALL BE USED TO CALCULATE THE SPEED REFERENCE SIGNAL.
- THE VFD SPEED RANGE OF OPERATION SHALL BE FROM 0% TO 100% FOR THE SYSTEM, WITH THE ACTUAL MINIMUM SPEED SET AS REQUIRED TO MEET MINIMUM VENTILATION REQUIREMENTS.
- AN INTERNAL ALGORITHM TO THE DIGITAL CONTROLLER SHALL MODULATE SUPPLY FAN VFD SPEED PROPORTIONAL TO ALL EXHAUST FANS THAT ARE LOCATED IN THE SAME FAN GROUP AS THE SUPPLY FAN.
- THE SYSTEM SHALL OPERATE IN PREP MODE DURING LIGHT COOKING LOAD OR COOL DOWN MODE WHEN SUFFICIENT HEAT REMAINS UNDERNEATH THE HOOD SYSTEM AFTER COOKING OPERATIONS HAVE COMPLETED. OPERATION DURING EITHER OF THESE PERIODS WILL DISABLE THE SUPPLY FANS AND PROVIDE AN EXHAUST FAN SPEED THAT IS EQUAL TO THE MINIMUM VENTILATION REQUIREMENT.
- A DIGITAL CONTROLLER SHALL DISABLE THE SUPPLY FAN(S), ACTIVATE THE EXHAUST FAN(S), ACTIVATE THE APPLIANCE SHUNT TRIP, AND DISABLE AN ELECTRIC GAS VALVE AUTOMATICALLY WHEN FIRE CONDITION IS DETECTED ON A COVERED HOOD.
- A DIGITAL CONTROLLER SHALL ALLOW FOR EXTERNAL BMS FAN CONTROL VIA DRY CONTACT (EXTERNAL CONTROL SHALL NOT OVERRIDE FAN OPERATION LOGIC AS REQUIRED BY CODE).
- AN LCD INTERFACE SHALL BE PROVIDED WITH THE FOLLOWING FEATURES:
  A. ON/OFF PUSH BUTTON FAN & LIGHT SWITCH ACTIVATION.
  B. INTEGRATED GAS VALVE RESET FOR ELECTRONIC GAS VALVES (NO RESET RELAY REQUIRED).
  C. VFD FAULT DISPLAY WITH AUDIBLE & VISUAL ALARM NOTIFICATION.
  D. DUCT TEMPERATURE SENSOR FAILURE DETECTION WITH AUDIBLE & VISUAL ALARM NOTIFICATION.
  E. MIS-WIRED DUCT TEMPERATURE SENSOR DETECTION WITH AUDIBLE & VISUAL ALARM NOTIFICATION.
  F. A SINGLE LOW VOLTAGE CAT-5 RJ45 WIRING CONNECTION.
  G. AN ENERGY SAVINGS INDICATOR THAT UTILIZES MEASURED KWH FROM THE VFDS.



TYPICAL HOOD CONTROL PANEL INSTALLATION

SEQUENCE OF OPERATIONS:

THE HOOD CONTROL PANEL IS CAPABLE OF OPERATING IN ONE OR MORE OF THE FOLLOWING STATES AT ANY GIVEN TIME:

- AUTOMATIC: THE SYSTEM OPERATES BASED ON THE DIFFERENTIAL BETWEEN ROOM TEMPERATURE AND THE TEMPERATURE AT THE HOOD CAVITY OR EXHAUST DUCT COLLAR. FANS ACTIVATE AT A CONFIGURABLE TEMPERATURE DIFFERENTIAL THRESHOLD. DEPENDING ON THE JOB CONFIGURATION EACH FAN ZONE CAN BE CONFIGURED AS STATIC OR DYNAMIC. THESE TERMS REFER TO WHETHER A VARIABLE MOTOR (SUCH AS EC MOTORS OR VFD DRIVEN MOTORS) MODULATE WITH TEMPERATURE. IF THE PANEL IS EQUIPPED WITH VARIABLE SPEED FANS AND THE ZONE IS DEFINED AS "DYNAMIC", THESE WILL MODULATE WITHIN A USER-DEFINED RANGE BASED ON THE TEMPERATURE DIFFERENTIAL. PANELS EQUIPPED WITH VARIABLE SPEED FANS AND A FAN ZONE DEFINED AS "STATIC", FANS WILL RUN AT A SET SPEED CALCULATED FOR THE DRIVE. DEMAND CONTROL VENTILATION SYSTEMS ARE CAPABLE OF MODULATING EXHAUST AND MAKE UP AIR FAN SPEEDS PER THE REQUIREMENTS OUTLINED IN IECC 403.7.5 (2021).
- MANUAL: THE SYSTEM OPERATES BASED ON HUMAN INPUT FROM AN HMI.
- SCHEDULE: A WEEKLY SCHEDULE CAN BE SET TO RUN FANS FOR A SPECIFIED PERIOD THROUGHOUT THE DAY. THERE ARE THREE OCCUPIED TIMES PER DAY TO ALLOW FOR THE USER TO SET UP A TIME THAT IS SUITABLE TO THEIR NEEDS. ANY TIME THAT IS WITHIN THE DEFINED OCCUPIED TIME, THE SYSTEM WILL RUN AT MODULATION MODE AND FOLLOW THE FAN PROCEDURE ALGORITHM BASED ON TEMPERATURE DURING THIS TIME. DURING UNOCCUPIED TIME, THE SYSTEM WILL HAVE AN EXTRA OFFSET TO PREVENT UNINTENDED ACTIVATION OF THE SYSTEM DURING A TIME WHERE THE SYSTEM IS NOT BEING OCCUPIED.
- OTHER: THE SYSTEM OPERATES BASED ON THE INPUT FROM AN EXTERNAL SOURCE (DDC, BMS OR HARD-WIRED INTERLOCK).
- FIRE: UPON ACTIVATION OF THE HOOD FIRE SUPPRESSION SYSTEM, THE EXHAUST FAN WILL COME ON OR CONTINUE TO TO RUN, THE HOOD MAKEUP AIR WILL SHUTDOWN, AND A SIGNAL WILL BE SENT FOR ACTIVATING THE SHUNT TRIP BREAKER PROVIDED BY THE ELECTRICIAN. FUEL GAS WILL SHUT OFF VIA A MECHANICAL/ELECTRICAL GAS VALVE ACTUATED BY THE HOOD FIRE SUPPRESSION SYSTEM.

REVISIONS

DESCRIPTION	DATE

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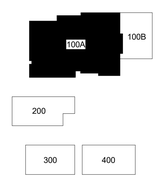
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Willow School Lansing
1012 W. Willow,
Lansing, MI 48915

DATE: 9/11/2023
DWG.#: 6214394
DRAWN BY: RJF
SCALE: 3/4" = 1'-0"
MASTER DRAWING
SHEET NO. 5

Lansing School District

ISSUANCE	DAT
CD COORDINATION	11.09.2023



KEY PLAN

LSD SB-005
JOB 230538
N

SHEET TITLE
FOODSERVICE VENTILATION DETAILS

SHEET NO.
FS6.5

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Autodesk Docs://Willow School Lansing Schools/Willow School FS.rvt

PLUMBING KEYNOTES

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P8 1/2" H&CW TO SHOWER.
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P17 3/4" H&CW, 2" V, AND 3" SAN UP TO SERVICE SINK.
P18 PROVIDE STRIEM LB-2 NEUTRALIZER IN PLACE OF P-TRAP.
P20 ROUTE ROOF HYDRANT DRAIN LINE SLOPED BACK TO THE MOP BASIN. PROVIDE CODE REQUIRED AIR GAP.
P21 REFER TO CIVIL PLANS FOR CONTINUATION.
P22 1/2" H&CW TO EMERGENCY EYEWASH MIXING VALVE. ROUTE 1/2" TEPID WATER TO EMERGENCY EYEWASH.
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9. PLUMBING VENT PIPING THRU THE ROOF SHALL BE LOCATED 10'-0" FROM ANY FRESH AIR INTAKE LOCATION AND A MINIMUM OF 18" CLEAR FROM THE INSIDE FACE OF PARAPET.
10. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR VALVES/CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. PROVIDE CLEANOUTS AT THE BASE OF ALL STACKS.
11. RUN ALL SANITARY AND STORM PIPING 2 1/2" OR LESS AT 1/4" PER FOOT AND 3" AND LARGER PIPING AT 1/8" PER FOOT MINIMUM UNLESS OTHERWISE NOTED. MINIMUM UNDERGROUND PIPE SIZE SHALL BE 3".
12. PROVIDE "IN-LINE" TRAP SEAL PROTECTION OR TRAP PRIMER ON ALL FLOOR DRAINS AND TRAPS SUBJECT TO EVAPORATION.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.

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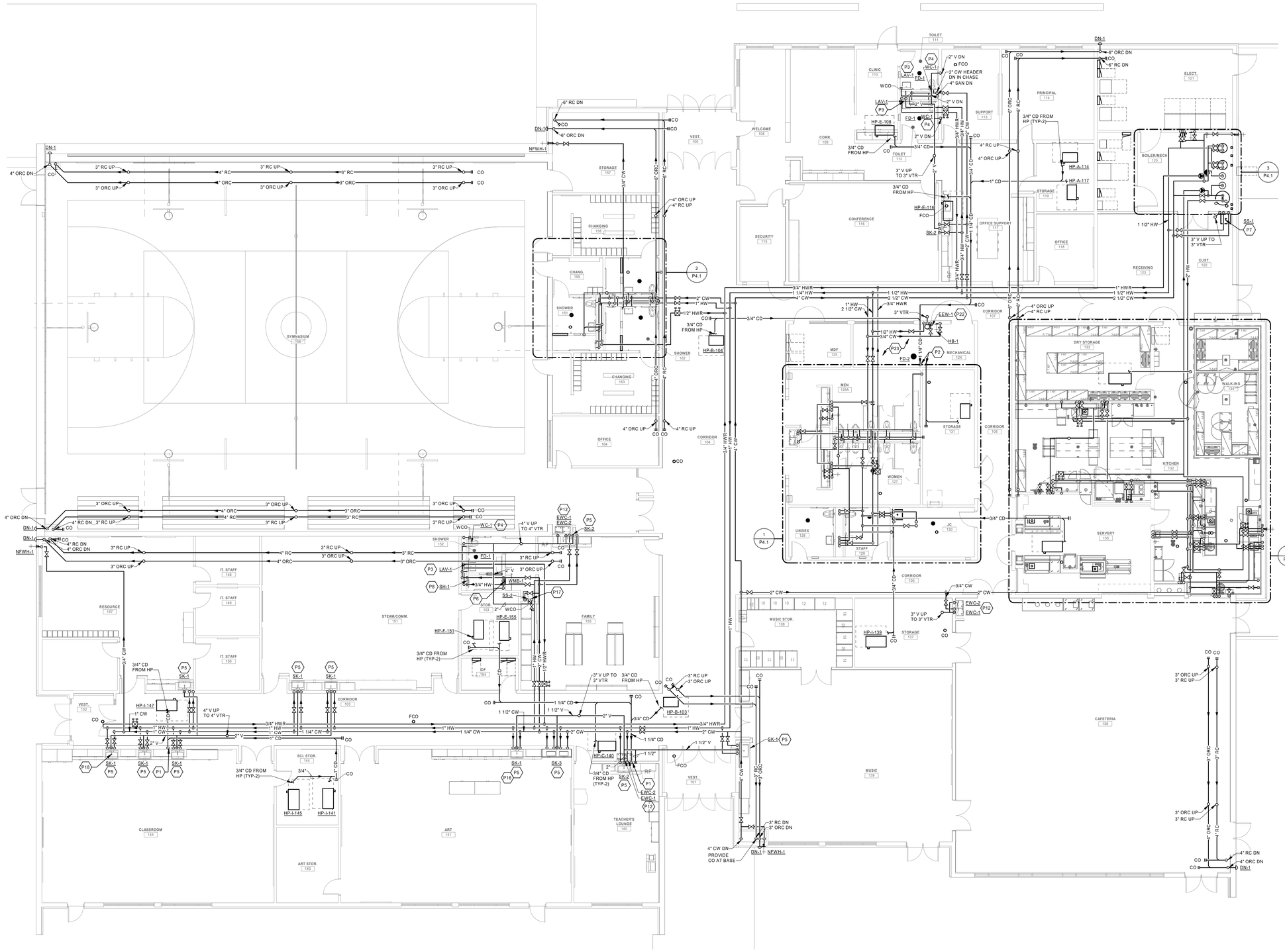

PLUMBING PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A 100B
200
300 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
PLUMBING PLAN - UNIT 100A

SHEET NO.
P1.1A

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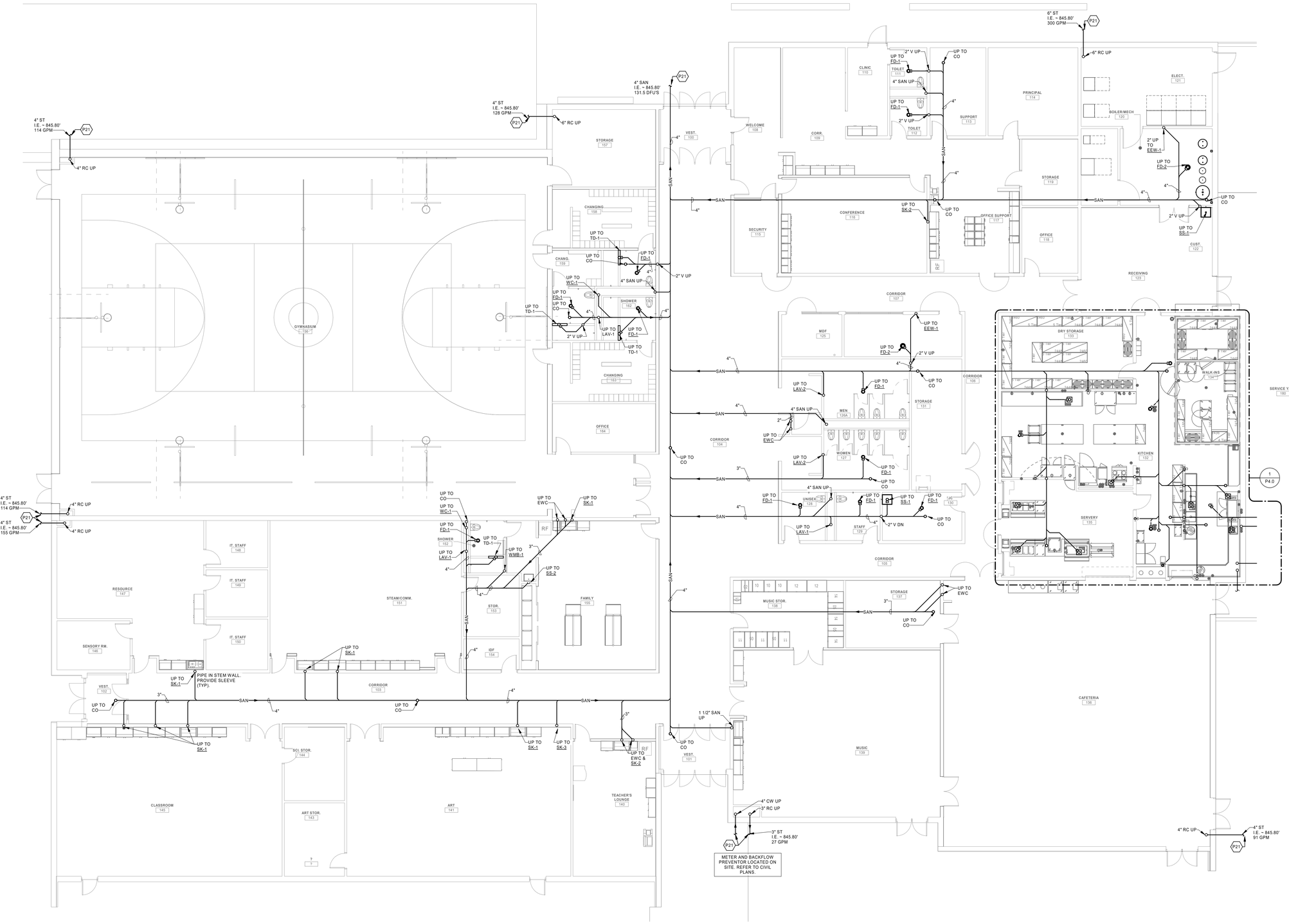
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



UNDERGROUND PLUMBING PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 62010074719
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A 100B 200 300 400

KEY PLAN

ISD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
UNDERGROUND PLUMBING PLAN - UNIT 100A

SHEET NO.
P1.1UGA

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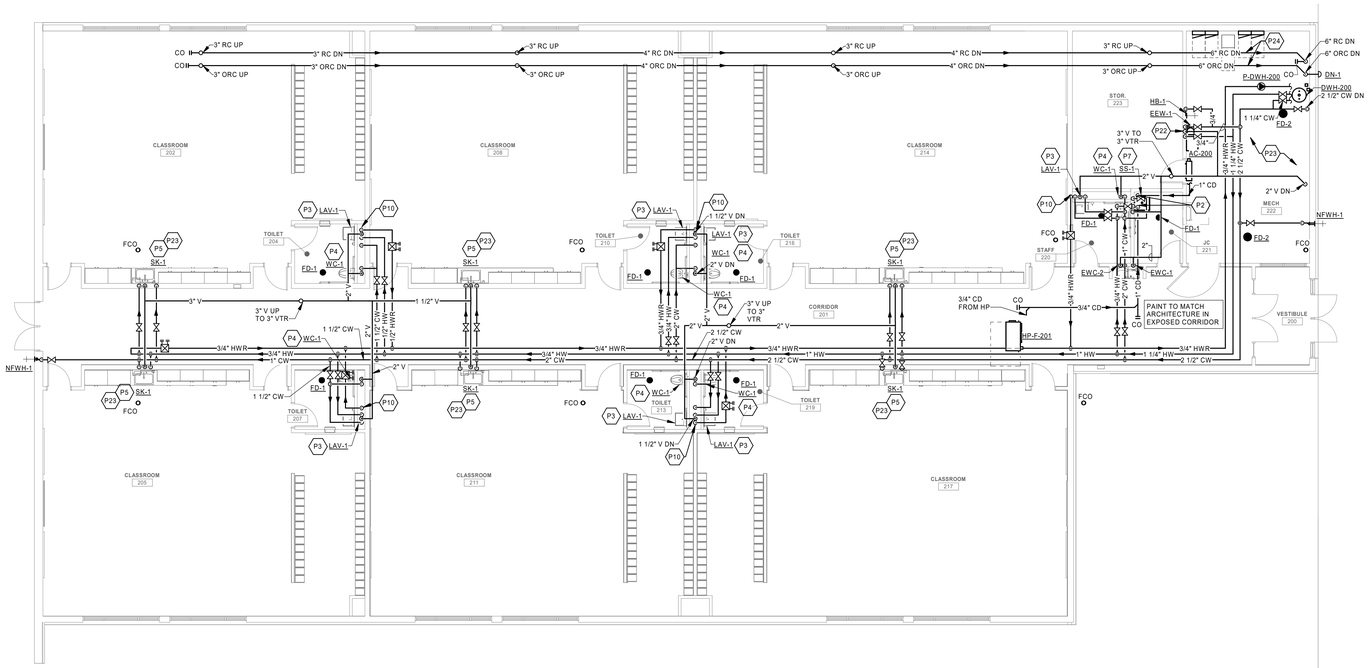

PLUMBING PLAN - UNIT 200

SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
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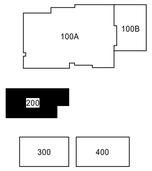
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PLUMBING PLAN - UNIT 200

SHEET NO.
P1.2

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KINGSCOTT
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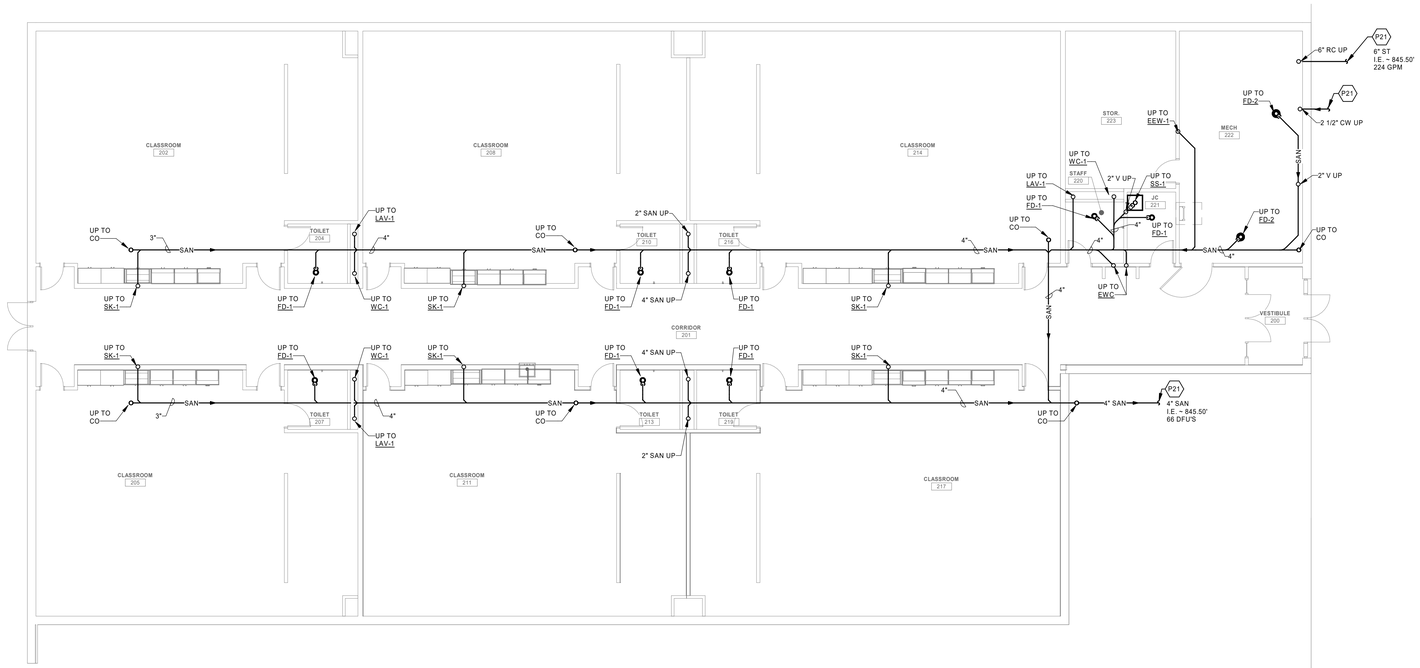

UNDERGROUND PLUMBING PLAN - UNIT 200

SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A | 100B | 200 | 300 | 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

UNDERGROUND PLUMBING PLAN - UNIT 200

SHEET NO.

P1.2UG

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

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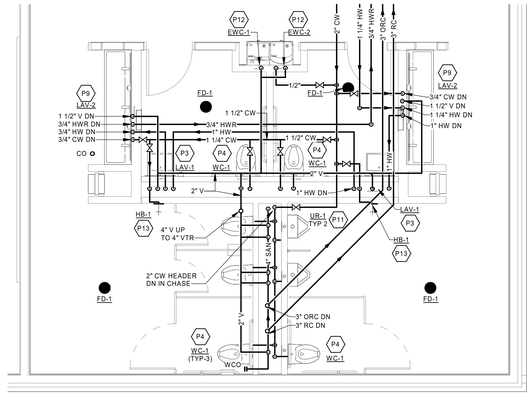
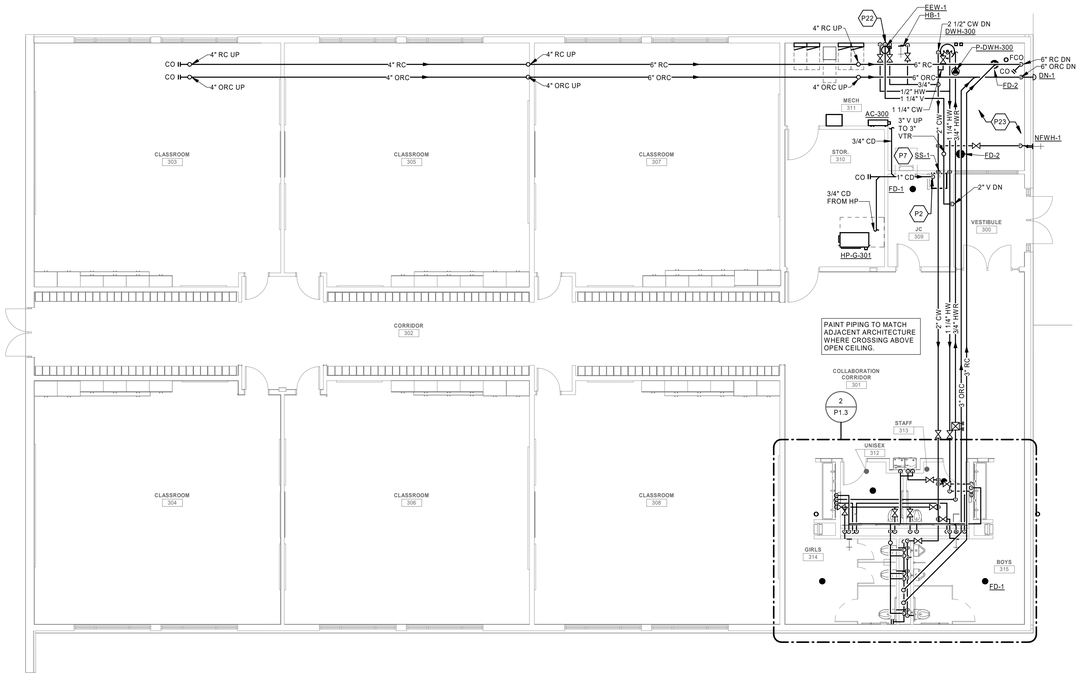


2 / P1.3 ENLARGED TOILET ROOM PLAN - UNIT 300
SCALE: 1/4" = 1'-0"



PLUMBING PLAN - UNIT 300
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SHEET NO.
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PLUMBING KEYNOTES

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P8 1/2" H&CW TO SHOWER.
P9 2" V, AND 2" SAN TO LAVATORY AND 1/2" H&CW TO EACH FAUCET. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE TO EACH FAUCET.
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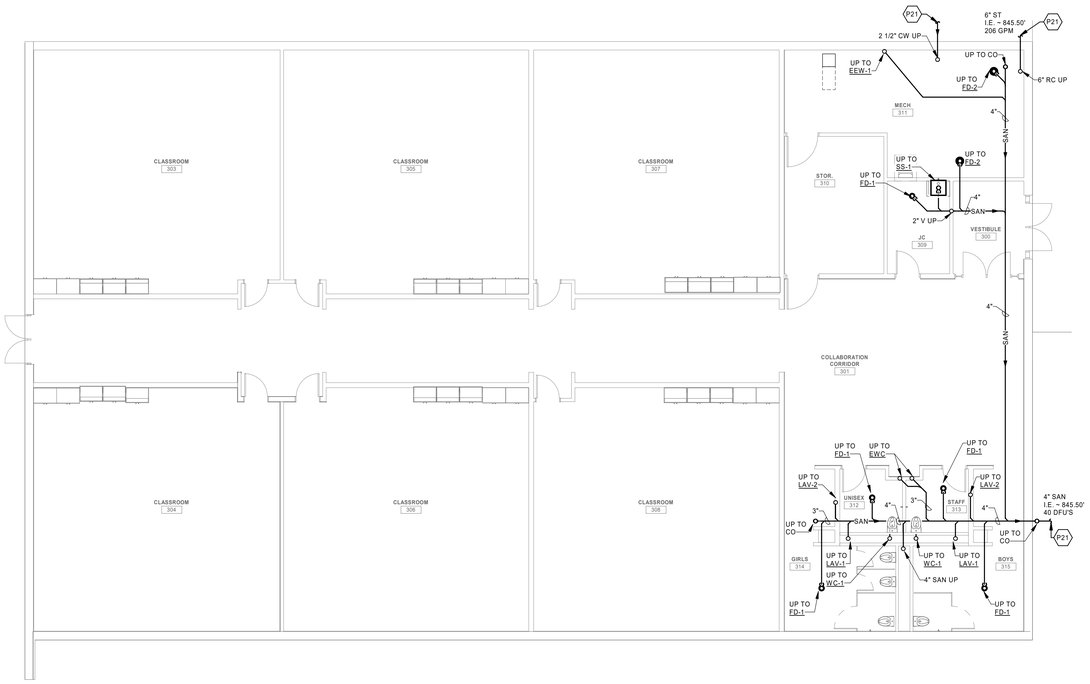


UNDERGROUND PLUMBING PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

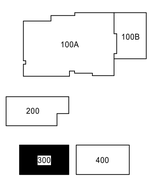
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
UNDERGROUND PLUMBING PLAN - UNIT 300

SHEET NO.
P1.3UG

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

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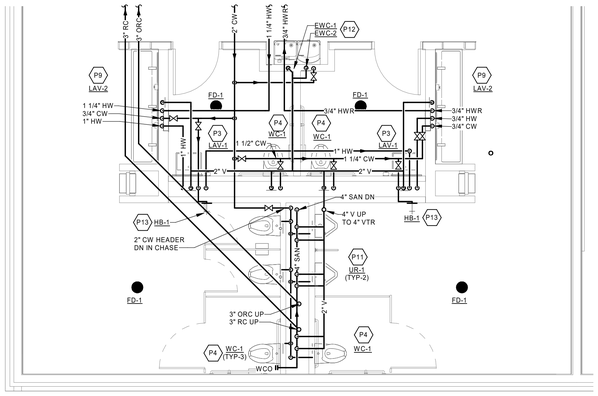
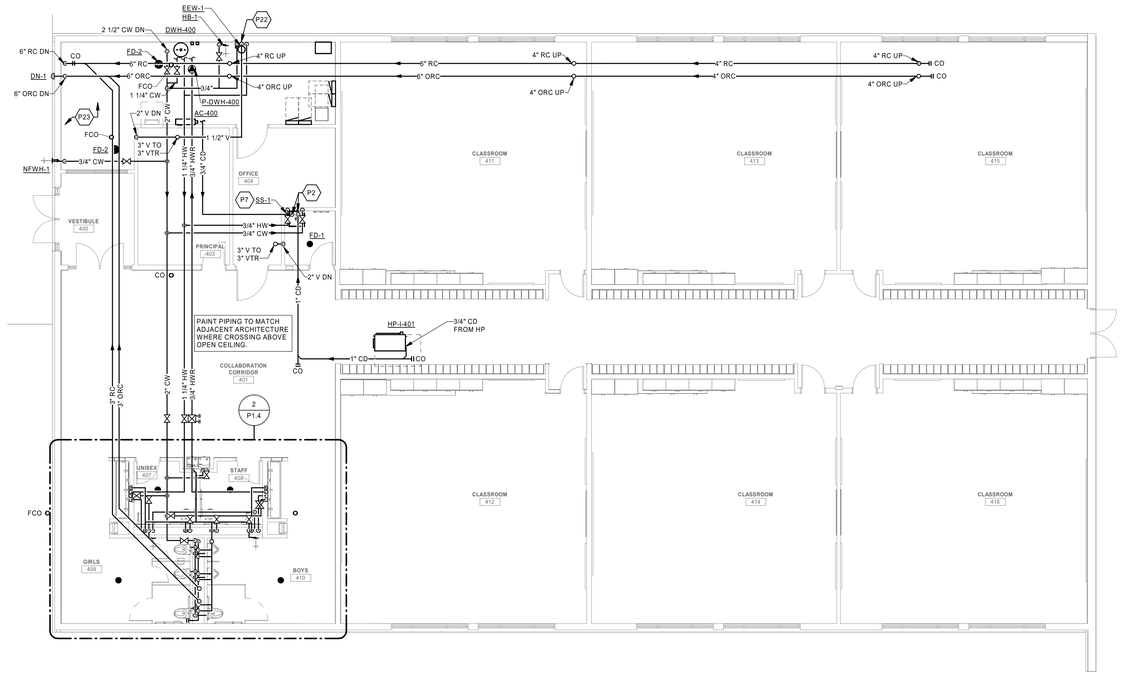


2 P1.4 ENLARGED TOILET ROOM PLAN - UNIT 400
SCALE: 1/4" = 1'-0"



PLUMBING PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

Willow School

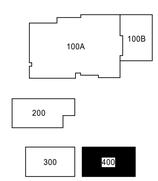
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
PLUMBING PLAN - UNIT 400

SHEET NO.
P1.4

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C:\Users\sbrDocuments\23 5568 SS_LSD Willow_MEP_2023_brendan.rvt

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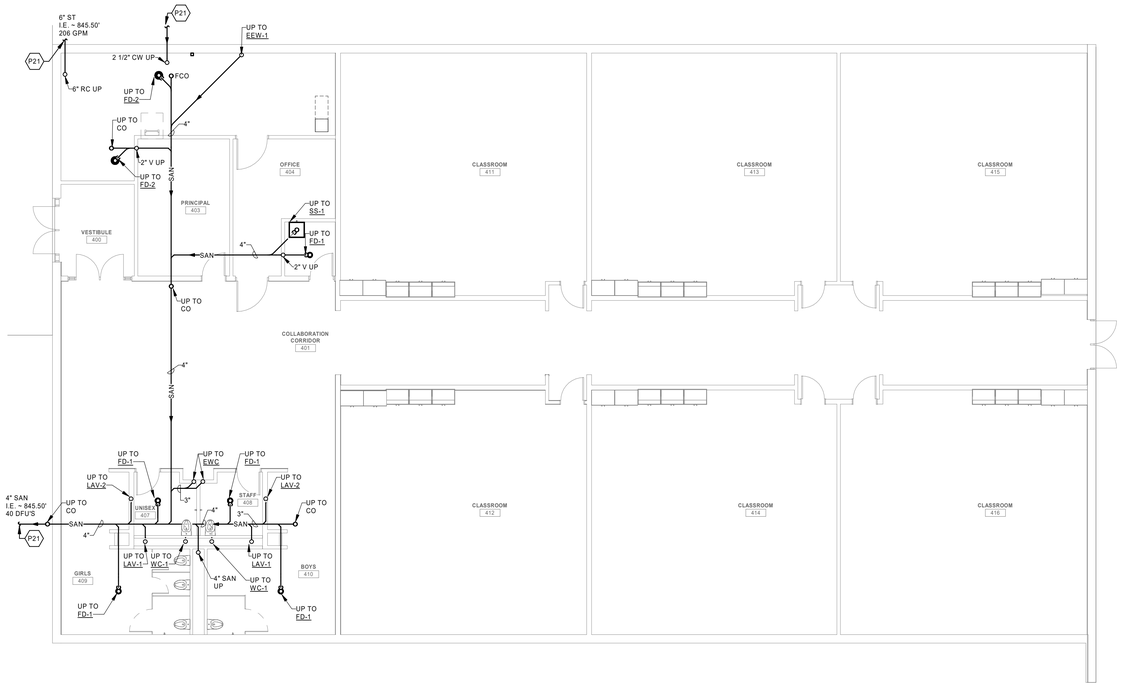

UNDERGROUND PLUMBING PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

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ISSUANCES	DATE
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100A 100B 200 300 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
UNDERGROUND PLUMBING PLAN - UNIT 400

SHEET NO.
P1.4UG

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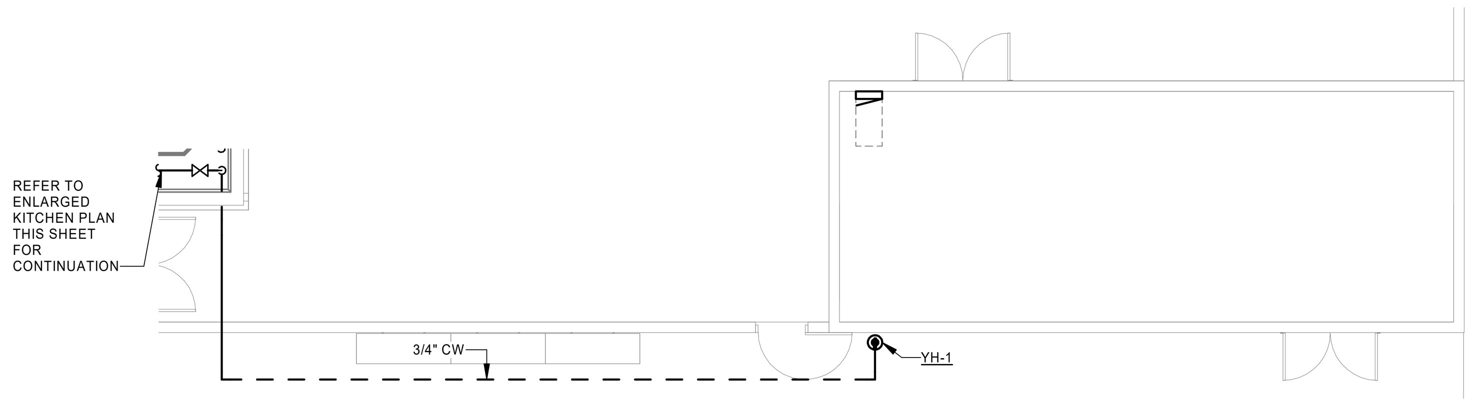
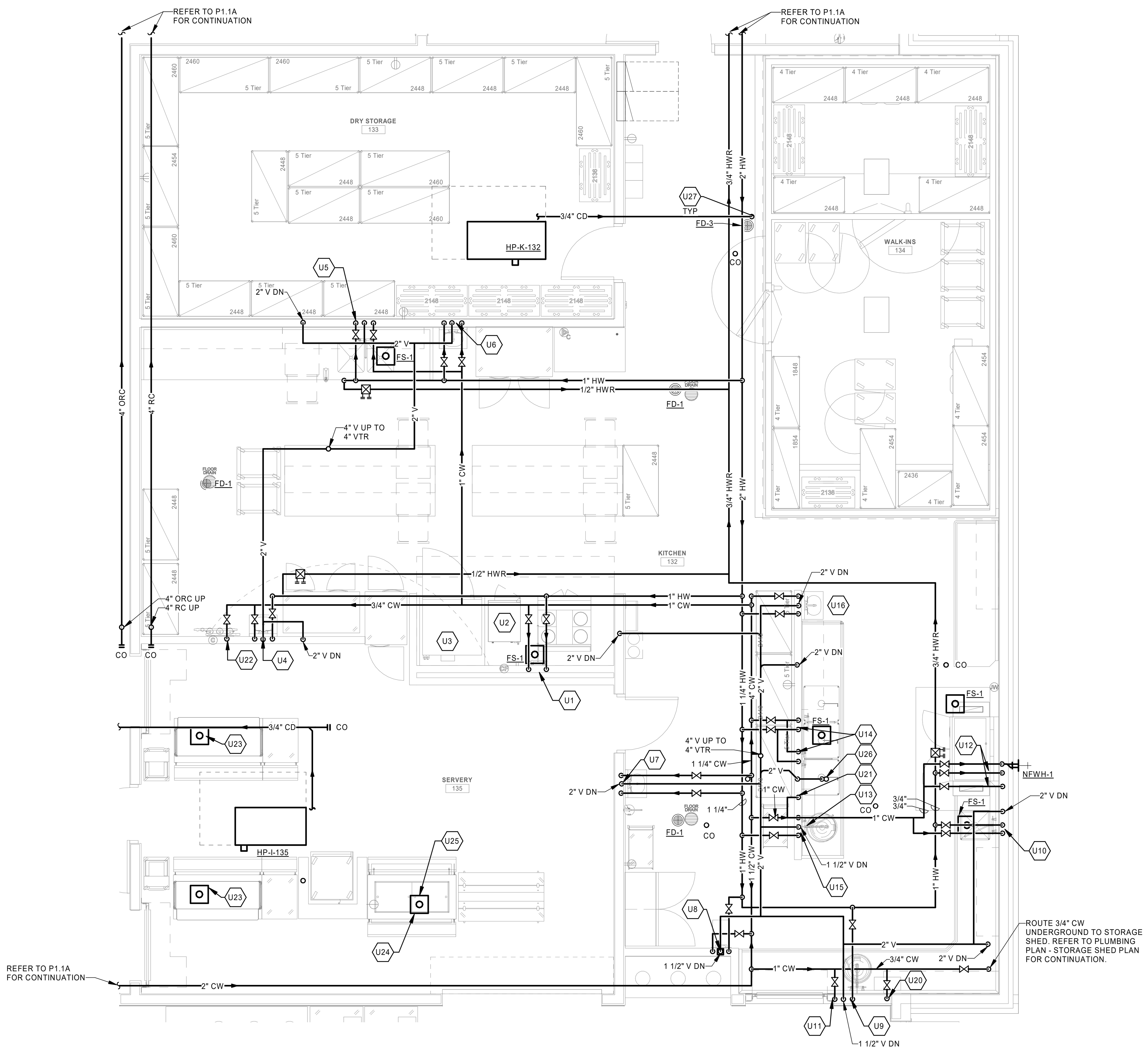
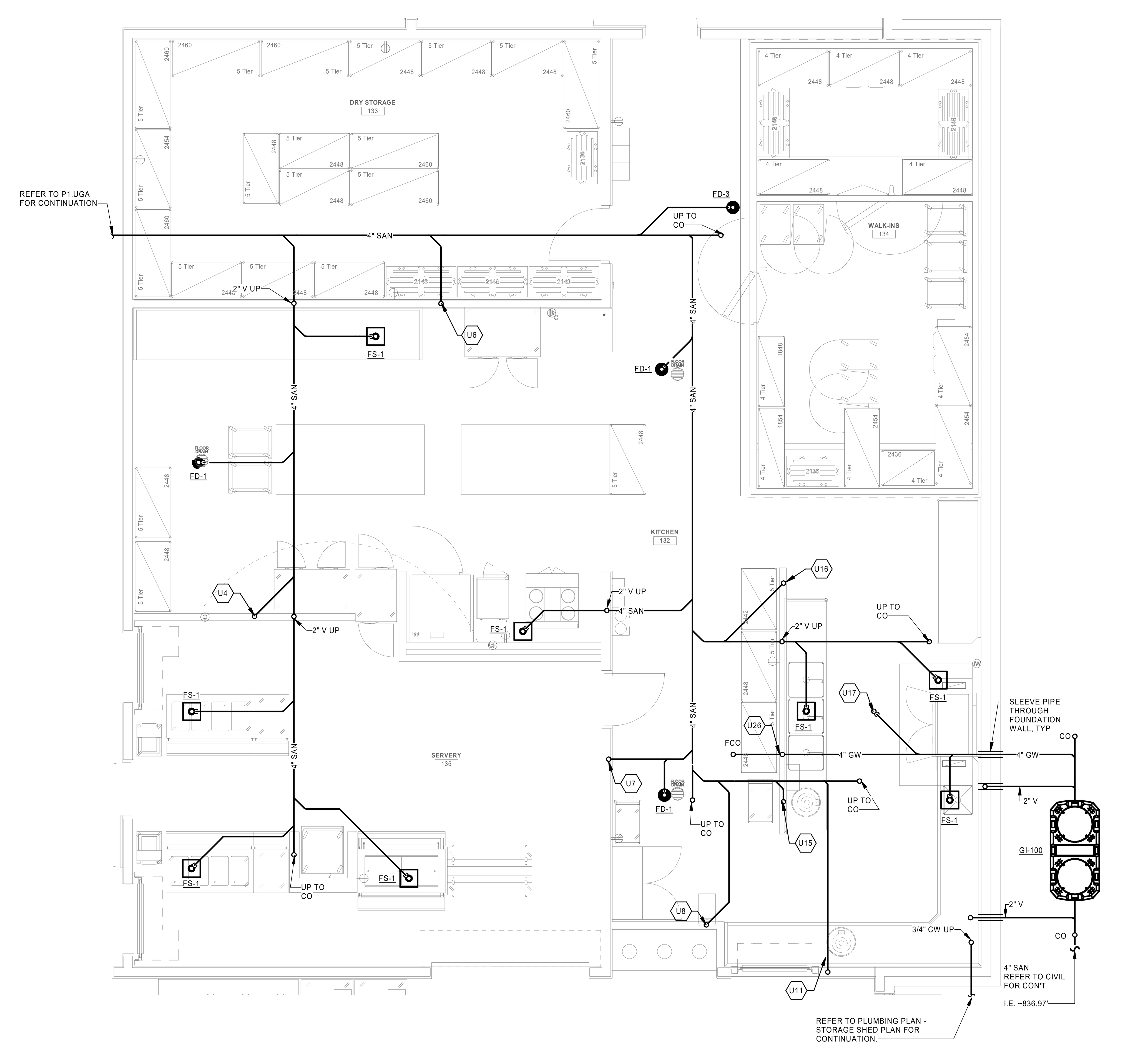


PLUMBING PLAN - STORAGE SHED
SCALE: 1/8" = 1'-0"



2 P1.1A ENLARGED KITCHEN PLUMBING PLAN
SCALE: 1/4" = 1'-0"



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FOOD SERVICE GENERAL NOTES

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2. FOR FOOD SERVICE EQUIPMENT SCHEDULE, CONNECTION SIZES, LOCATIONS AND FURTHER EQUIPMENT INFORMATION, REFER TO FOOD SERVICE EQUIPMENT CONSULTANTS (F.S.E.C) EQUIPMENT LAYOUT DRAWINGS, PLUMBING PLANS, AND OWNER EQUIPMENT SPECIFICATIONS. VERIFY AND COORDINATE UTILITY CONNECTION LOCATIONS, SIZES, LOADS, ETC. WITH THE FOOD SERVICE EQUIPMENT SUPPLIER. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHTS OF ALL PLUMBING FIXTURES. REFER TO PLUMBING FIXTURE SCHEDULE FOR FIXTURE TYPES, CONNECTIONS, ACCESSORIES AND ADDITIONAL REQUIREMENTS.
3. PROVIDE ADEQUATE ACCESS TO ALL FLOOR SINKS FOR CLEANING. ALL FLOOR SINKS AND FLOOR DRAINS IN TRAFFIC AREAS SHALL BE INSTALLED FLUSH TO FLOOR SURFACE. IF THE CABINET HAS A BOTTOM SHELF WITH AN OPENING TO A FLOOR SINK, THE OPENING SHALL BE BOXED IN FROM THE SHELF TO THE FLOOR AND SEALED.
4. PROVIDE INLINE TRAP SEAL PROTECTION OR TRAP PRIMER FOR ALL FLOOR DRAINS, FLOOR SINKS AND TRAPS SUBJECT TO EVAPORATION LOSS.
5. PROVIDE RIGID DRAIN LINES FROM FOOD SERVICE EQUIPMENT (INCLUDING WALK-IN REFRIGERATORS AND FREEZERS) SLOPED TO AN INDIRECT WASTE WITH AN AIR GAP. EACH INDIRECT WASTE PIPE FROM FOOD HANDLING FIXTURES OR EQUIPMENT, INCLUDING ICE STORAGE BINS AND ICE MACHINES, SHALL NOT BE DIRECTLY CONNECTED WITH ANOTHER WASTE LINE.
6. ABOVE GRADE WASTE LINES FROM ICE BINS, ICE MAKERS, REFRIGERATORS AND FREEZERS TO FLOOR SINKS, OPEN SITE DRAINS AND TROUGH DRAINS SHALL BE INSULATED TO PREVENT CONDENSATION. INSULATION MUST BE SMOOTH, NON-ABSORBENT AND EASY TO CLEAN.
7. ATMOSPHERIC VACUUM BREAKERS (ASSE 1001) MUST BE PROVIDED ON ALL DISPOSERS, DISHWASHERS, AND ON ALL WATER LINES THAT SUPPLY FOOD SERVICE EQUIPMENT THROUGH SUBMERGED INLETS. ATMOSPHERIC VACUUM BREAKERS MUST BE INSTALLED A MINIMUM OF 6" ABOVE THE HIGHEST INLET OR FIXTURE ON ITS DOWNSTREAM SIDE. DO NOT LOCATE ANY SOLENOID OR MANUAL SHUT-OFF VALVES DOWNSTREAM OF AN ATMOSPHERIC VACUUM BREAKER. PROVIDE AN ASSE 1055 BACKFLOW PREVENTER ON WATER LINES TO A SOAP OR CHEMICAL DISPENSER. PROVIDE A PRESSURE TYPE BACKFLOW PREVENTER (ASSE 1020) ON THE WATER LINE TO AN OVERHEAD SPRAY WASHER. PRESSURE VACUUM BREAKERS MUST BE INSTALLED A MINIMUM OF 12" ABOVE THE HIGHEST INLET OR FIXTURE ON IT'S DOWNSTREAM SIDE. PROVIDE A VENTED DOUBLE CHECK ASSEMBLY (ASSE 1022) ON ALL ICE AND BEVERAGE EQUIPMENT REQUIRING A WATER CONNECTION. PLUMBING VENTS THROUGH THE ROOF SHALL BE A MINIMUM OF 12" ABOVE THE ROOF.
8. PRIOR TO START OF WORK, REFER TO KITCHEN CONSULTANT'S APPROVED SHOP DRAWINGS FOR COMPLETE INFORMATION ON KITCHEN EQUIPMENT PLUMBING REQUIREMENTS. P.C. SHALL VERIFY ALL MOUNTING HEIGHTS, SIZES AND CONNECTION REQUIREMENTS WITH EQUIPMENT SUPPLIER AND ALL MILLWORK DRAWINGS PRIOR TO ROUGH-IN. P.C. SHALL ROUGH-IN UTILITY LINES THROUGH WALLS AND FLOORS, CONNECT WASTE LINES FROM ROUGH-INS, MAKE ALL CONNECTIONS TO THE FOOD SERVICE EQUIPMENT AND PROVIDE ALL TRAPS, VALVES, PIPING, ETC., NEEDED FOR PROPER INSTALLATION OF ALL FOOD SERVICE EQUIPMENT.

PLUMBING GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC & INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE PLUMBING SYSTEMS COMPLETE AND PER APPLICABLE CODES INCLUDING REQUIRED COMPONENTS, OFFSETS REQUIRED TO AVOID THE STRUCTURE, ETC.
2. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHT OF ALL PLUMBING FIXTURES, BOTH STANDARD AND BARRIER FREE. REFER TO PLUMBING FIXTURE SCHEDULE FOR FIXTURE TYPES, BRANCH CONNECTION SIZES AND ADDITIONAL REQUIREMENTS.
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6. PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL MAINTAIN REQUIRED CLEARANCES OVER, AROUND AND IN FRONT OF ALL ELECTRICAL EQUIPMENT, PANELS, TRANSFORMERS, ETC. PIPING SHALL NOT INTERFERE WITH, OR BE INSTALLED IN A LOCATION THAT RESTRICTS ACCESS OR CLEARANCE TO ELECTRICAL OR MECHANICAL DEVICES. PROVIDE REQUIRED ACCESS AND CLEARANCE AROUND ALL EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS.
7. CONTRACTOR SHALL PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL PLUMBING SYSTEMS.
8. PROVIDE BRANCH LINE ISOLATION VALVES ON DOMESTIC PIPING TO EACH GROUP OF FIXTURES AND TOILET ROOMS.
9. PLUMBING VENT PIPING THRU THE ROOF SHALL BE LOCATED 10'-0" FROM ANY FRESH AIR INTAKE LOCATION AND A MINIMUM OF 18" CLEAR FROM THE INSIDE FACE OF PARAPET.
10. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR VALVES/CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. PROVIDE CLEANOUTS AT THE BASE OF ALL STACKS.
11. RUN ALL SANITARY AND STORM PIPING 2 1/2" OR LESS AT 1/4" PER FOOT AND 3" AND LARGER PIPING AT 1/8" PER FOOT MINIMUM UNLESS OTHERWISE NOTED. MINIMUM UNDERGROUND PIPE SIZE SHALL BE 3".
12. PROVIDE "INLINE" TRAP SEAL PROTECTION OR TRAP PRIMER ON ALL FLOOR DRAINS AND TRAPS SUBJECT TO EVAPORATION.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14 IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.

PLUMBING ENLARGED KEYNOTES

- U1 FSE-18: 1/2" CW & HW DOWN IN WALL TO FILLER FAUCET.
- U2 FSE-19: 3/4" CW DOWN IN WALL TO CONVECTION STEAMER. ROUTE 1-1/4" INDIRECT WASTE TO NEAREST FLOOR SINK.
- U3 FSE-20: 3/4" FW DOWN IN WALL TO CONVECTION STEAMER. ROUTE 2" INDIRECT WASTE TO FLOOR SINK.
- U4 FSE-25: 1/2" CW & HW DOWN IN WALL, AND 1-1/2" SAN UP TO HAND SINK. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
- U5 FSE-40.1: 1/2" CW & HW DOWN IN WALL, AND 2" SAN UP TO SINK.
- U6 FSE-45: 1/2" CW & HW DOWN IN WALL, AND 1-1/2" SAN UP TO HAND SINK. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
- U7 FSE-59: 1/2" CW & HW DOWN IN WALL, AND 1-1/2" SAN UP TO HAND SINK. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
- U8 FSE-67: 1/2" CW & HW DOWN IN WALL TO TMV-2. 1/2" TW TO EYEWASH STATION. 2" SAN UP TO EYE WASH STATION.
- U9 FSE-70.1: 1/2" CW & HW DOWN IN WALL TO PRE-RINSE FAUCET. 2" INDIRECT WASTE TO FLOOR SINK.
- U10 FSE-70.3: 1/2" CW & HW DOWN IN WALL TO PRE-RINSE FAUCET.
- U11 FSE-72: 1/2 CW DOWN IN WALL TO DISPOSER, AND 2" SAN UP TO DISPOSER.
- U12 FSE-77: 1/2" CW & HW DOWN IN WALL TO DISHWASHER. ROUTE 2" INDIRECT WASTE TO NEAREST FLOOR SINK.
- U13 FSE-85.1: 1/2" CW & HW DOWN IN WALL TO PRE-RINSE FAUCET.
- U14 FSE-85.2 & 85.3: 1/2" CW & HW DOWN IN WALL TO 3-COMPARTMENT SINK FAUCETS.
- U15 FSE-86: 1/2" CW DOWN IN WALL. PROVIDE STRIEM SIDEKICK SOLIDS INTERCEPTOR DOWNSTREAM OF DISPOSER. ROUTE 2" SAN FROM INTERCEPTOR.
- U16 FSE-89: 1/2" CW & HW DOWN IN WALL, AND 1-1/2" SAN UP TO HAND SINK. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
- U17 FSE-84: 4" SAN TO FLOOR TROUGH OUTLET.
- U20 FSE-70.2: 1/2" CW DOWN IN WALL TO SANITIZER.
- U21 FSE-85.4: 1/2" CW TO SANITIZER.
- U22 FSE-19.1: 3/4" CW TO FILTRATION SYSTEM. PLUMB FROM FILTRATION SYSTEM TO ALL LOCATIONS. SEE FS DRAWINGS.
- U23 FSE-1&9: ROUTE INDIRECT WASTE FROM HOT SERVING COUNTER TO FLOOR SINK.
- U24 FSE-12: ROUTE INDIRECT WASTE FROM COLD SERVING COUNTER TO FLOOR SINK.
- U25 FSE-13: ROUTE INDIRECT WASTE FROM MILK COOLER TO FLOOR SINK.
- U26 ROUTE 2" SAN UP TO SINK BASIN.
- U27 ROUTE CONDENSATE DRAIN IN CEILING AND DISCHARGE ABOVE SERVICE SINK/FLOOR DRAIN.

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN STEVEN K. GUNTHER, JR. ENGINEER No. 6201067419 LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ENLARGED KITCHEN PLUMBING PLANS

SHEET NO.
P4.0

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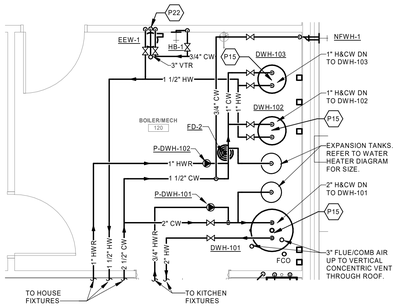
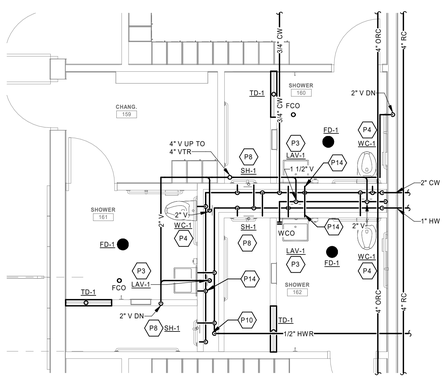
PLUMBING KEYNOTES

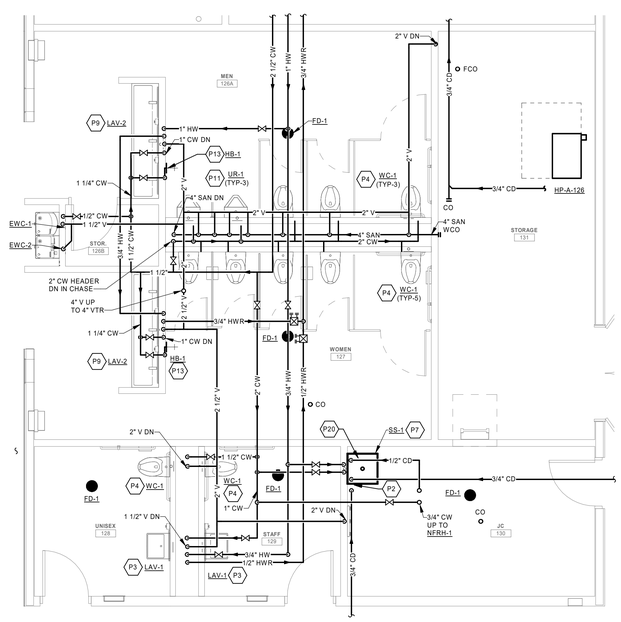
P1 ROUTE CONDENSATE DRAIN DOWN IN WALL TO HUB DRAIN UNDER SINK.
P2 ROUTE CONDENSATE DRAIN IN CEILING AND DISCHARGE ABOVE SERVICE SINK/FLOOR DRAIN.
P3 1/2" H&CW, 1-1/2" V, AND 1-1/2" SAN TO LAVATORY. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
P4 1" CW, 2" V, AND 4" SAN TO WATER CLOSET
P5 1/2" H&CW, 2" V, AND 2" SAN TO SINK. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE.
P6 3/4" H&CW, 2" V, AND 2" SAN TO WASHING MACHINE BOX.
P7 3/4" H&CW, 2" V, AND 3" SAN TO FLOOR MOUNTED SERVICE SINK.
P8 1/2" H&CW TO SHOWER.
P9 2" V, AND 2" SAN TO LAVATORY AND 1/2" H&CW TO EACH FAUCET. PROVIDE POINT-OF-USE THERMOSTATIC MIXING VALVE TO EACH FAUCET.
P10 1/2" HWR UP FROM FINAL HW CONNECTION. SEE DETAIL ON SHT. P5.0. TYPICAL OF LAV LOCATIONS AND WHERE NOTED.
P11 3/4" CW, 1-1/2" V, AND 2" SAN TO URINAL.
P12 1/2" CW, 1-1/2" V, AND 1-1/2" SAN TO ELECTRIC WATER COOLER.
P13 3/4" CW TO HOSE BIB.
P14 PROVIDE WATER SAVER TRAP PRIMER FROM LAVATORY SINK TO SHOWER TRENCH DRAIN.
P15 REFER TO DOMESTIC WATER HEATER PIPING DIAGRAM FOR CONNECTION.
P16 PROVIDE STRIEM USI-1180 CLAY TRAP WITH REMOVABLE BUCKET AND FILTER IN PLACE OF A P-TRAP.
P17 3/4" H&CW, 2" V, AND 3" SAN UP TO SERVICE SINK.
P18 PROVIDE STRIEM LB-2 NEUTRALIZER IN PLACE OF P-TRAP.
P20 ROUTE ROOF HYDRANT DRAIN LINE SLOPED BACK TO THE MOP BASIN. PROVIDE CODE REQUIRED AIR GAP.
P21 REFER TO CIVIL PLANS FOR CONTINUATION.
P22 1/2" H&CW TO EMERGENCY EYEWASH MIXING VALVE. ROUTE 1/2" TEPID WATER TO EMERGENCY EYEWASH.
P23 ALL PIPING TO BE PAINTED WITHIN MECHANICAL ROOM. COORDINATE WITH ARCHITECTURAL AND INTERIOR DRAWINGS AND TRADES.
P24 PROVIDE DRAIN PAN BELOW ANY PLUMBING PIPING TO PROTECT ELECTRICAL EQUIPMENT BELOW.



3 / P1.1A P4.1 - ENLARGED BOILER ROOM PLUMBING PLAN - UNIT 100
SCALE: 1/4" = 1'-0"



2 / P1.1A P4.1 - ENLARGED TOILET GROUP PLUMBING PLAN - UNIT 100
SCALE: 1/4" = 1'-0"



1 / P1.1A P4.1 - ENLARGED PLUMBING PLAN - UNIT 100
SCALE: 1/4" = 1'-0"

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN R. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ENLARGED PLUMBING PLANS

SHEET NO.
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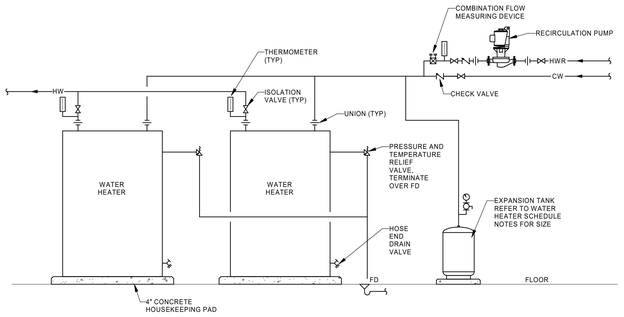
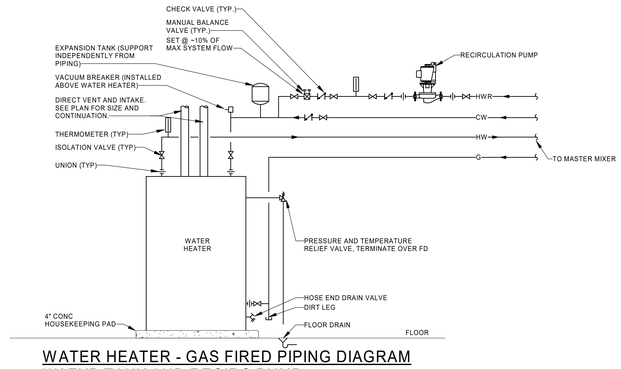


WATER HEATER - ELECTRIC PIPING DIAGRAM
NO SCALE



WATER HEATER - GAS FIRED PIPING DIAGRAM W/ EXP TANK AND RECIRC PUMP
NO SCALE

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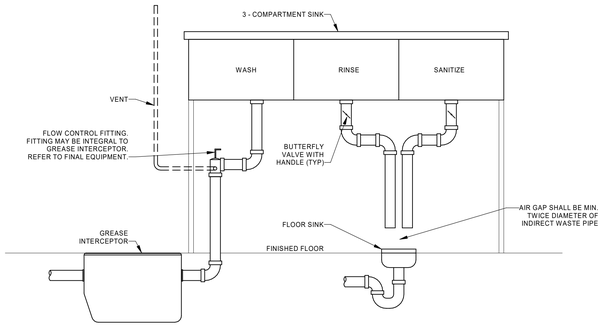
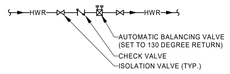
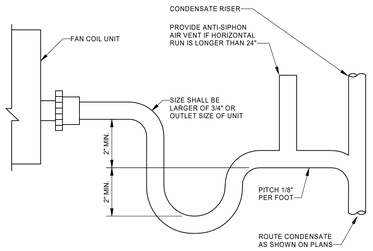


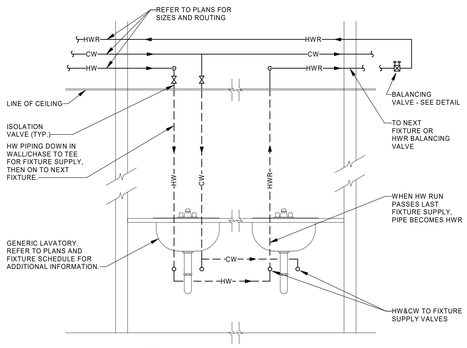


NOTE:
1. PROVIDE AT ALL HWR CONNECTION TO HW MAIN/BRANCH.

BALANCING VALVE ASSEMBLY DETAIL
NO SCALE

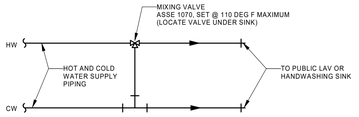


CONDENSATE DRAIN - FAN COIL DETAIL
NO SCALE

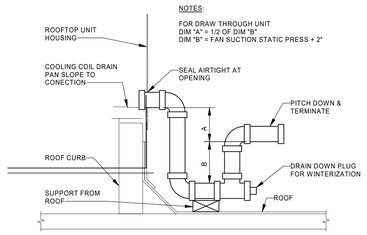


NOTES:
1. NUMBER OF LAVS VARY - REFER TO FLOOR PLANS

TYPICAL LAVATORY HW / HWR PIPING DETAIL
NO SCALE

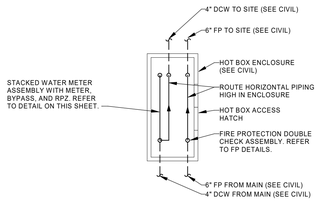


POINT OF USE THERMOSTATIC MIXING VALVE DETAIL
NO SCALE

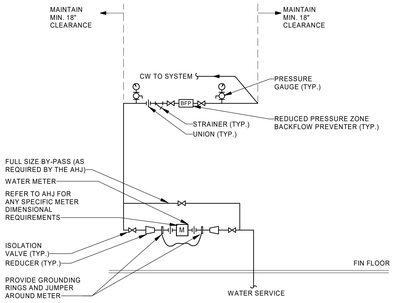


RTU COOLING COIL DRAIN PAN TRAP DETAIL
NO SCALE

LOCATED ON HOT BOX ENCLOSURE. REFER TO CIVIL.



WATER METER HOT BOX DIAGRAM
NO SCALE



NOTES:
1. WATER METER AND BACK FLOW PREVENTER SHALL BE SUPPORTED FROM THE FLOOR.

WATER METER WITH STACKED RPZ DETAIL
NO SCALE

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PLUMBING DETAILS

SHEET NO.
P5.0

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PLUMBING FIXTURES/SPECIALTIES SCHEDULE

TAG	BARRIER FREE	ITEM	PIPE CONNECTION SIZES WASTE	VENT	CW	HW	MANUFACTURER & MODEL NO.	ACCESSORIES
EEW-1	-	EMERGENCY EYE/FACE WASH - PEDESTAL			1/2"	1/2"	HAWS 7777	CORROSION RESISTANT; STAINLESS STEEL DUST COVER, UNIVERSAL EMERGENCY SIGN AND STAY OPEN BALL VALVE ASSEMBLY, PROVIDE WITH TEST TAG AND ASSE 1071 MIXING VALVE.
EWC-1	Y	ELECTRIC WATER COOLER - SINGLE WITH BOTTLE FILLER	1 1/2"	1 1/2"	1/2"		ELKAY LZS8WSSK	PUSHBAR ACTIVATION WITH VANDAL-RESISTANT BUBBLER. 120V, 1 PH, 6 FLA, 370 WATTS, SHUT OFF VALVE AND 1-1/2" P-TRAP, VISUAL FILTER MONITOR. PROVIDE REPLACEMENT FILTERS (3-PACK)
EWC-2	-	ELECTRIC WATER COOLER - SINGLE WITH BOTTLE FILLER	1 1/2"	1 1/2"	1/2"		ELKAY LZS8WSSK	PUSHBAR ACTIVATION WITH VANDAL-RESISTANT BUBBLER. 120V, 1 PH, 6 FLA, 370 WATTS, SHUT OFF VALVE AND 1-1/2" P-TRAP, VISUAL FILTER MONITOR. PROVIDE REPLACEMENT FILTERS (3-PACK)
FD-1	-	FLOOR DRAIN - GENERAL	3"				ZURN Z415S-Y	TYPE "S" STRAINER AND SEDIMENT BUCKET. CAST IRON BODY WITH BOTTOM OUTLET, COMBINATION INVERTIBLE MEMBRANE CLAMP AND ADJUSTABLE COLLAR.
FD-2	-	FLOOR DRAIN - MECHANICAL ROOM	4"				JR SMITH 2330Y	12" ROUND TOP WITH SEDIMENT BUCKET AND VANDAL PROOF CAST IRON ADA GRATE.
FD-3	-	FLOOR DRAIN - INDIRECT WASTE	4"				JR SMITH 2005Y	6" ROUND TOP WITH ADJUSTABLE NICKEL BRONZE STRAINER. PROVIDE WITH OVAL FUNNEL FOR INDIRECT WASTE.
FS-1	-	FLOOR SINK	2"				JR SMITH 300 SERIES	12" SQUARE BODY WITH PORCELAIN ENAMEL, ACID RESISTANT COATED CAST IRON BODY AND GRATE WITH ANTI-SPLASH DOME STRAINER AND 1/2 GRATE. IN FOOD SERVICE APPLICATIONS - COORDINATE RIM ELEVATION AFF WITH AHJ.
HB-1	-	HOSE BIBB - INTERIOR PUBLIC AREAS			3/4"		JR SMITH 5618	MODERATE CLIMATE NARROW WALL HYDRANT WITH INTEGRAL VACUUM BREAKER, REMOVABLE KEY
LAV-1	Y	LAVATORY - WALL MOUNTED	1 1/2"	1 1/2"	1/2"	1/2"	KOHLER GREENWICH K-2032 WITH SLOAN ETF-600 FAUCET	20.75"x18.25" LAVATORY VITREOUS CHINA WALL HUNG WITH FRONT OVERFLOW; ELECTRONIC SENSOR FAUCET 24 VAC, 50/60 HZ, VANDAL RESISTANT OUTLET WITH 0.5 GPM MAX FLOW RATE. PROVIDE WITH ASSE 1070 MIXING VALVE.
LAV-2	Y	LAVATORY - 3-STATION WASH BASIN	1 1/2"	1 1/2"	3/4"	3/4"	BRADLEY VERGE LVAD3 WITH VERGE S53-3500 FAUCET	VITREOUS CHINA 3-STATION WASH BASIN WITH QUARTZ EVERO CLASSIC - GEO SERIES ANTARCTICA FINISH.; VERGE LINEA SERIES FAUCET SHALL BE TOUCH FREE VANDAL RESISTANT OUTLET WITH 0.5 GPM MAX FLOW RATE. SILICONE TIP WITH BRUSHED STAINLESS FINISH. PROVIDE WITH AC ADAPTOR (COORDINATE WITH ELECTRICAL) PROVIDE WITH ASSE 1070 MIXING VALVE. PROVIDE DR1 SS TRENCH DRAIN CAP.
NFRH-1	-	NON-FREEZE ROOF HYDRANT			3/4"		JR SMITH 5906	3/4" HOSE CONNECTION; PROVIDE WITH VACUUM BREAKER; PROVIDE ALL MOUNTING HARDWARE AND PIPE, FULL SIZE DRAIN TO APPROPRIATE RECEPTOR. COORDINATE INSTALLATION WITH ROOFING CONTRACTOR PRIOR TO COMPLETION OF ROOF WORK.
NFWH-1	-	NON-FREEZE WALL HYDRANT			3/4"		JR SMITH 5509QT	BRONZE NICKEL PLATED, QUARTER TURN SELF DRAINING NON-FREEZE HYDRANT WITH INTEGRAL VACUUM BREAKER, "T" HANDLE KEY AND STAINLESS STEEL LOCKING BOX WITH "W" ON COVER.
ORS-1	-	OVERFLOW ROOF SUMP					MIFAB R1100-W-U	ADJUSTABLE WATER DAM, UNDERDECK CLAMP AND LOW PROFILE DOME
RS-1	-	ROOF SUMP					MIFAB R1100-U	UNDERDECK CLAMP AND LOW PROFILE DOME
SH-1	Y	SHOWER	2"	1 1/2"	1/2"	1/2"	SYMMONS ORIGINS 9605-PLR-TRM	SHOWER/HAND SHOWER TRIM WITH 1 MODE. WALL MOUNTED METAL LEVER HANDLE WITH 1.5 GPM SHOWER HEAD, ARM AND FLANGE, SYMMONS TUB/SHOWER VALVE 262XBODY, AND HANDHELD WAND WITH HOSE AND 36" SLIDE/GRAB BAR. ALL COMPONENTS SHALL BE POLISHED CHROME FINISH. PRESSURE BALANCED MIXING VALVE SHALL MEET ASSE 1016 AND HAVE UNIVERSAL INLETS/OUTLETS AND SUPPLY STOPS.
SK-1	Y	SINK - STAINLESS STEEL UNDERMOUNT	1 1/2"	1 1/2"	1/2"	1/2"	KOHLER UNDERTONE K-3332-NA WITH CHICAGO 50-E35-317XKABCP FAUCET	23"x17.5"x7.5"SINGLE BOWL UNDERMOUNT STAINLESS STEEL SINK WITH PERFECT DRAIN. MANUAL FAUCET SHALL BE 6" GOOSENECK WITH WRIST BLADE HANDLES, 1.5 GPM VANDAL RESISTANT LAMINAR FLOW OUTLET. PROVIDE WITH ASSE 1070 MIXING VALVE.
SK-2	Y	SINK - STAINLESS STEEL UNDERMOUNT	1 1/2"	1 1/2"	1/2"	1/2"	KOHLER UNDERTONE K-3325-NA WITH KOHLER SIMPLICE K-596 FAUCET	23"x17.5"x9.5"SINGLE BOWL UNDERMOUNT STAINLESS STEEL SINK WITH PERFECT DRAIN. 9" GOOSENECK WITH PULL DOWN 1.5 GPM SWING FAUCET WITH VIBRANT STAINLESS FINISH, 1.5 GPM VANDAL RESISTANT LAMINAR FLOW OUTLET. PROVIDE SOLIDS INTERCEPTOR EQUAL TO STRIEM SIDEKICK WITH FRONT ACCESS. PROVIDE P-TRAP AND PROVIDE WITH ASSE 1070 MIXING VALVE. PROVIDE CONNECTIONS FROM DISHWASHER TO SINK DRAIN AND HW SUPPLY PER DISHWASHER MFR INSTRUCTIONS. PROVIDE CW CONNECTION TO REFRIGERATOR ICE MAKER.
SK-3	Y	SINK - 2 STATION WASH BASIN	1 1/2"	1 1/2"	1/2"	1/2"	BRADLEY VERGE LVAD2 WITH VERGE FAUCET - LINEA SERIES	QUARTZ 2-STATION WASH BASIN WITH QUARTZ EVERO CLASSIC - GEO SERIES ANTARCTICA FINISH.; VERGE LINEA SERIES FAUCET SHALL BE TOUCH FREE VANDAL RESISTANT OUTLET WITH 0.5 GPM MAX FLOW RATE. SILICONE TIP WITH BRUSHED STAINLESS FINISH. PROVIDE WITH AC ADAPTOR (COORDINATE WITH ELECTRICAL) PROVIDE WITH ASSE 1070 MIXING VALVE. PROVIDE DR1 SS TRENCH DRAIN CAP.
SS-1	-	SERVICE SINK	3"	1 1/2"	3/4"	3/4"	FIAT STOCKTON TSBC-1611 WITH CHICAGO 540-LD897SWXF317CP FAUCET	32"x32"x12" CORNER MOP SERVICE BASIN WITH STAINLESS STEEL CAPS ON CORNER THRESHOLD. PROVIDE FIAT 832AA HOSE & HOSE BRACKET, MSG WALL GUARDS, AND MOP HANGER. FAUCET SHALL BE WALL MOUNTED 8" FIXED CENTER WITH VACUUM BREAKER, WRISTEBLADE HANDLES, INTEGRAL STOPS, PAIL HOOK.
SS-2	-	SERVICE TUB	3"	1 1/2"	3/4"	3/4"	FIAT P-1 WITH FIAT A-1	24"x20"x15.75" FLOOR MOUNTED SERVICE/LAUNDRY TUB. POLY TUB WITH (4) 20" TALL PAINTED STEEL LEGS. FAUCET SHALL SHALL BE DECK MOUNTED 4" CENTERS SWING SPOUT, LEVER HANDLES, CHROME FINISH. PROVIDE ONE INTEGRAL DRAIN WITH DRAIN PLUG, 1-1/2" TAILPIECE, P-TRAP WITH C.O. PLUG PER DRAIN.
TD-1	-	TRENCH DRAIN	2"				LUXE LINEAR - SQUARE PATTERN	PROVIDE SLOPED INNER CHANNEL FOR CENTER DRAINAGE. PROVIDE WITH LUXE 2" PVC DRAIN BASE.
UR-1	Y	URINAL - WALL MOUNTED	2"	1 1/2"	3/4"		KOHLER DEXTER K-5016-ET WITH SLOAN ROYAL 186-1 FLUSH VALVE	ADA, VITREOUS CHINA, WALL MOUNTED, TOP SPUD; DIAPHRAGM-TYPE, POLISHED CHROME MANUAL FLUSH VALVE, 1.0 GPF
WC-1	Y	WATER CLOSET - FLUSH VALVE, WALL MOUNTED	4"	2"	1"		KOHLER KINGSTON ULTRA K-84325 WITH SLOAN ROYAL 111-1.6 FLUSH VALVE	ADA, VITREOUS CHINA, WALL MOUNTED, ELONGATED BOWL, TOP SPUD, ANTIMICROBIAL FINISH; PROVIDE OLSONITE 95CT ELONGATED TOILET SEAT, HEAVY DUTY, OPEN FRONT SEAT; DIAPHRAGM-TYPE, POLISHED CHROME MANUAL FLUSH VALVE, 1.6 GPF
WMB-1	-	WASHING MACHINE BOX	2"	1 1/2"	1/2"	1/2"	SIOUX CHIEF OX BOX SERIES 696	WITH WATER HAMMER ARRESTORS
YH-1	-	NON-FREEZE YARD HYDRANT			3/4"		JR SMITH 5909	3/4" HOSE CONNECTION; PROVIDE WITH VACUUM BREAKER; PROVIDE ALL MOUNTING HARDWARE AND PIPE. PROVIDE LOCKABLE COLLAR SOLD SEPARATELY.

NOTES:
1. PROVIDE ALL SLEEVES, TEMPLATES, HARDWARE, ACCESSORIES, ETC. REQUIRED FOR A COMPLETE AND OPERABLE INSTALLATION. VERIFY ALL COLORS AND FINISHES WITH ARCHITECT AND REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHT OF ALL FIXTURES.
2. PROVIDE CARRIERS FOR ALL APPLICABLE FIXTURES PER MANUFACTURER'S RECOMMENDATIONS. CONCEALED ARM CARRIERS REQUIRED FOR SINGLE STATION LAVATORIES. PROVIDE ALL CARRIERS WITH FOOT SUPPORTS.
3. WHERE REQUIRED AND/OR DESIGNATED, FIXTURES SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE STATE'S BARRIER FREE DESIGN REQUIREMENTS & ICC/ANSI A117.1. ALL EXPOSED LAVATORY AND SINK TRIM ON WHEELCHAIR ACCESSIBLE FIXTURES SHALL BE COVERED WITH A SEAMLESS ANTIMICROBIAL VINYL INSULATING OUTER SHELL.
4. PROVIDE ASSE 1072 BARRIER-TYPE INLINE TRAP SEAL DEVICES FOR EACH FLOOR DRAIN AND FLOOR SINK AND TRAP SUBJECT TO EVAPORATION LOSS.
5. PROVIDE COMMERCIAL GRADE SUPPLIES TO SINKS AND LAVATORIES WITH CHROME PLATED BRASS LOOSE KEY ANGLE STOPS WITH BRASS STEMS (NO PLASTIC STEMS), WHERE APPLICABLE PROVIDE ESCUTCHEON PLATE.
6. PROVIDE POINT OF USE THERMOSTATIC MIXING VALVES, ASSE 1070, FOR ALL ADA SINKS AND HANDWASHING SINKS.

DOMESTIC WATER HEATER SCHEDULE (GAS TANK TYPE)

UNIT ID	LOCATION / AREA SERVED	STORAGE CAPACITY (GAL)	FUEL TYPE	GAS PRESS. MIN.-MAX. (IN WG)	INPUT (MBH)	RECOVERY AT 100°F (GPH)	THERMAL EFFICIENCY	ELECTRICAL MOCP	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
DWH-101	UNIT 100 KITCHEN	119	NG	4.5-14	400	456	94	15	120	1	EC	EC	-	BRADFORD WHITE / EF-120T-400-3N(A)	

NOTES:
1. 4" CONCRETE HOUSEKEEPING CURB.
2. FLA SHALL BE PROVIDED FROM MANUFACTURER'S LITERATURE AND SHALL BE INCLUDED IN PRODUCT DATA SUBMITTAL TO ENGINEER.
3. PROVIDE CONDENSATE NEUTRALIZATION KIT.
4. UNIT TO BE POWER DIRECT VENTED.
5. LEAK DETECTION KIT.
6. DWH-101 EXPANSION TANK: ASME, MFR: B&G, MODEL: PTA30V, QTY: 1, REQ. TANK VOL.: 15 GAL, REQ. ACCEPTANCE VOL.: 10 GAL, VERTICAL, DIAPHRAGM, WITH AIR PRESSURE GAUGE AND BLADDER MONITOR DEVICE. PROVIDE 4" CONCRETE HOUSEKEEPING CURB.
7. PROVIDE BACNET COMMUNICATION GATEWAY.

DOMESTIC HOT WATER RECIRULATION PUMP SCHEDULE

UNIT ID	SYSTEM SERVED	TYPE	FLOW (GPM)	HEAD (FT)	ELECTRICAL kW (INPUT)	ELECTRICAL BHP	ELECTRICAL HP	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
P-DWH-101	UNIT 100 KITCHEN	INLINE	5	10	0.6	0.03	-	115	1	EC	EC	SWITCH	B&G ECOCIRC XL N 20-23	SET ON CONSTANT PRESSURE MODE
P-DWH-102	UNIT 100 HOUSE	INLINE	10	25	0.5	-	0.5	208	1	EC	EC	SWITCH	B&G ECOCIRC XL N 36-45	SET ON CONSTANT PRESSURE MODE
P-DWH-200	UNIT 200	INLINE	5	15	0.1	-	1/12	115	1	EC	EC	SWITCH	B&G ECOCIRC XL N 20-35	SET ON CONSTANT PRESSURE MODE
P-DWH-300	UNIT 300	INLINE	5	15	0.1	-	1/12	115	1	EC	EC	SWITCH	B&G ECOCIRC XL N 20-35	SET ON CONSTANT PRESSURE MODE
P-DWH-400	UNIT 400	INLINE	5	15	0.1	-	1/12	115	1	EC	EC	SWITCH	B&G ECOCIRC XL N 20-35	SET ON CONSTANT PRESSURE MODE

NOTES:
1. PERFORMANCE BASED ON WATER, UNLESS OTHERWISE INDICATED.
2. PUMPS SHALL BE NON-OVERLOADING.
3. PUMP SHALL HAVE EC MOTOR AND SHALL HAVE BUILT IN OVERLOAD AND THERMAL PROTECTION, NO ADDITIONAL OVERLOAD PROTECTION IS REQUIRED.
4. PUMPS SHALL BE INSTALLED IN ORIENTATION RECOMMENDED BY MFG.

DOMESTIC WATER HEATER SCHEDULE (ELECTRIC TANK TYPE)

UNIT ID	LOCATION / AREA SERVED	STORAGE CAPACITY (GAL)	RECOVERY AT 90°F (GPH)	ELECTRICAL INPUT (KW)	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
DWH-102	UNIT 100 HOUSE	80	24	4	208	1	EC	EC	-	BRADFORD WHITE / RE2H80T10	
DWH-103	UNIT 100 HOUSE	80	24	4	208	1	EC	EC	-	BRADFORD WHITE / RE2H80T10	
DWH-200	UNIT 200	50	24	4	208	1	EC	EC	-	BRADFORD WHITE / RE2H50T10	
DWH-300	UNIT 300	50	24	4	208	1	EC	EC	-	BRADFORD WHITE / RE2H50T10	
DWH-400	UNIT 400	50	24	4	208	1	EC	EC	-	BRADFORD WHITE / RE2H50T10	

NOTES:
1. FLA SHALL BE PROVIDED FROM MANUFACTURER'S LITERATURE AND SHALL BE INCLUDED IN PRODUCT DATA SUBMITTAL TO ENGINEER.
2. 4" CONCRETE HOUSEKEEPING CURB.
3. DWH-102/103 EXPANSION TANK: ASME, MFR: B&G, MODEL: PTA-30V, QTY: 1, REQ. TANK VOL.: 15 GAL, REQ. ACCEPTANCE VOL.: 10 GAL, VERTICAL, DIAPHRAGM, WITH AIR PRESSURE GAUGE AND BLADDER MONITOR DEVICE. PROVIDE 4" CONCRETE HOUSEKEEPING CURB.
4. DWH-200/300/400 EXPANSION TANK: ASME, MFR: B&G, MODEL: PTA-12V, QTY: 1, REQ. TANK VOL.: 5 GAL, REQ. ACCEPTANCE VOL.: 3.3 GAL, VERTICAL, DIAPHRAGM, WITH AIR PRESSURE GAUGE AND BLADDER MONITOR DEVICE.

GREASE INTERCEPTOR SCHEDULE

UNIT ID	FLOW RATE (GPM)	GREASE CAPACITY (LBS)	INSTALLATION TYPE	DIMENSIONS HEIGHT (IN)	DIMENSIONS LENGTH (IN)	DIMENSIONS WIDTH (IN)	MANUFACTURER / MODEL NO.	REMARKS
GI-100	100	1895	UNDERGROUND	44"	87"	33"	SHIER / GB-250	

NOTES:
1. PROVIDE WITH FIELD CUT RISER SYSTEM, FCR2, ACCESSORY FOR EACH COVER (2). COORDINATE RISER HEIGHT REQUIRED IN FIELD WITH ALL OTHER TRADES.
2. PROVIDE WITH CAST IRON COVERS.
3. INTEGRAL AIR RELIEF / ANTI-SIPHON / SAMPLING ACCESS.

THERMOSTATIC MIXING VALVE SCHEDULE

UNIT ID	SYSTEM SERVED	MIN. FLOW (GPM)	MAX. FLOW (GPM)	PRESS. DROP AT MAX. FLOW (PSIG)	MANUFACTURER / MODEL NO.	REMARKS
TMV-1	SINGLE SINK/LAVATORY	0.5	1.5	5.00	BRADLEY NAVIGATOR S59-4007	ASSE 1070
TMV-2	EMERGENCY EYE WASH	3.0	5.0	5.00	BRADLEY S19-2150 (EFX20)	ASSE 1071

NOTES:
1. PIPE PER MFR INSTRUCTIONS.
2. LEAD FREE DESIGN WITH CHECK VALVES ON SUPPLY INLETS.
3. ADJUSTABLE SETPOINT.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PLUMBING SCHEDULES

SHEET NO.
P6.0

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LAST PRINTED: 3/14/2024 1:19:46 PM
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MECHANICAL ABBREVIATIONS

ABBREV.	DESCRIPTION
AAV	AUTOMATIC AIR VENT / AIR ADMITTANCE VALVE
AD	ACCESS DOOR
AE	AIR EXTRACTOR
AFF	ABOVE FINISHED FLOOR
APD	AIR PRESSURE DROP
ASR	AUTOMATIC SPRINKLER RISER
BAS	BUILDING AUTOMATION SYSTEM
BFP	BACKFLOW PREVENTER
BHP	BRAKE HORSEPOWER
BMS	BUILDING MANAGEMENT SYSTEM
BOD	BOTTOM OF DUCT
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNITS PER HOUR
BWV	BACKWATER VALVE
CA	COMBUSTION AIR
CAP	CAPACITY
CAV	CONSTANT AIR VOLUME
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CIRC	CIRCULATING
CLG	COOLING
CO	CLEAN OUT
CONT	CONTINUATION OR CONTINUED
CONV	CONVECTOR
CUH	CABINET UNIT HEATER
CV	CONTROL VALVE
DB	DRY BULB TEMPERATURE
DEG	DEGREES
DDC	DIRECT DIGITAL CONTROL
DN	DOWN
DTC	DRAIN TILE CONNECTION
DWH	DOMESTIC WATER HEATER
(E)	EXISTING
EA/EXH	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB TEMPERATURE
EF	EXHAUST FAN
EJ	EXPANSION JOINT
EL	ELEVATION
ELECT	ELECTRICAL
EMS	ENERGY MANAGEMENT SYSTEM
ESP	EXTERNAL STATIC PRESSURE
EWB	ENTERING WET BULB TEMPERATURE
EWC	ELECTRIC WATER COOLER
°F	DEGREES FAHRENHEIT
FA	FACE AREA (COIL) / FREE AREA (LOUVER)
FC	FLEXIBLE CONNECTION
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FHR	FIRE HOSE RACK
FHV	FIRE HOSE VALVE
FL	FLUE
FLA	FULL LOAD AMPS
FLR	FLOOR
FPM	FEET PER MINUTE
FFD	FUNNEL FLOOR DRAIN
FFE	FINISHED FLOOR ELEVATION
FS	FLOOR SINK
FT	FEET
FURN	FURNISHED
FV	FACE VELOCITY
FVC	FIRE VALVE CABINET
GAL	GALLON
GCO	GRADE CLEAN OUT
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HB	HOSE BIBB

MECHANICAL ABBREVIATIONS

ABBREV.	DESCRIPTION
HO	HUB OUTLET
HP	HORSEPOWER
HR	HOUR
HTG	HEATING
HYD	HYDRANT
HZ	HERTZ
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCHES
INST	INSTALLED
INV	INVERT
ISP	INTERNAL STATIC PRESSURE
IW	INDIRECT WASTE
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LAV	LAVATORY
LBS/HR	POUNDS PER HOUR
LDB	LEAVING DRY BULB TEMPERATURE
LRA	LOCKED ROTOR AMPS
LWB	LEAVING WET BULB TEMPERATURE
MAV	MANUAL AIR VENT
MAX	MAXIMUM
MBH	1000 BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPACITY
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MOD	MOTOR OPERATED DAMPER (AUTOMATIC)
MOP/MOCP	MAXIMUM OVER-CURRENT PROTECTION
N.C.	NOISE CRITERIA
NIC	NOT IN CONTRACT
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NOM	NOMINAL
OA	OUTSIDE AIR
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER / CENTER TO CENTER
OD	OUTSIDE DIAMETER
OED	OPEN ENDED DUCT
ORS	OVERFLOW ROOF SUMP
OS&Y	OUTSIDE SCREW AND YOKE
PD	PRESSURE DROP (FEET OF WATER)
PRV	PRESSURE REDUCING VALVE
PSIA	POUNDS PER SQUARE INCH - ABSOLUTE
PSIG	POUNDS PER SQUARE INCH - GAUGE
PT	PRESSURE / TEMPERATURE PORT
RA	RETURN AIR
RH	RELATIVE HUMIDITY
REQD	REQUIRED
REL.A	RELIEF AIR
RPM	REVOLUTIONS PER MINUTE
RPZ	REDUCED PRESSURE ZONE
RS	ROOF SUMP
SA	SUPPLY AIR
SH	SHOWER
SP	STAIR PRESSURE
SP	STATIC PRESSURE
SqFt / SF	SQUARE FOOT/SQUARE FEET
SS	SERVICE SINK
TC	TEMPERATURE CONTROL
TCC	TEMPERATURE CONTROLS CONTRACTOR
T & P	TEMPERATURE AND PRESSURE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY

MECHANICAL ABBREVIATIONS

ABBREV.	DESCRIPTION
UNO	UNLESS NOTED OTHERWISE
UR	URINAL
VD	VOLUME DAMPER (MANUALLY ADJUSTABLE)
VTR	VENT THRU ROOF
W	WASTE
W&V	WASTE AND VENT
WB	WET BULB TEMPERATURE
WC	WATER CLOSET
WG	WATER GAUGE
WH	WALL HYDRANT
YCO	YARD CLEAN OUT

MECHANICAL PIPING SYMBOLS

ABBREV.	DESCRIPTION
	PIPE ELBOW UP
	PIPE ELBOW DOWN
	PIPE TEE DOWN
	DIRECTION OF FLOW
	UNION
	STRAINER
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	EXPANSION JOINT
	FLEXIBLE CONNECTION
	PIPE ANCHOR
	PIPE GUIDE
	PIPE CAP OR PLUG
	ISOLATION VALVE
	CIRCULATING PUMP
	GLOBE VALVE
	BALL VALVE
	BUTTERFLY VALVE
	BACKWATER VALVE
	ANGLE VALVE
	CHECK VALVE (SWING)
	CHECK VALVE (SPRING)
	PLUG VALVE
	NEEDLE VALVE
	OUTSIDE SCREW AND YOKE VALVE (OS&Y)
	PRESSURE REGULATING VALVE
	SOLENOID VALVE
	CONTROL VALVE (2-WAY / 3-WAY)
	FAN
	AUTOMATIC GAS SHUT-OFF VALVE
	TRAP (PLAN VIEW)
	FLOOR DRAIN / FUNNEL FLOOR DRAIN (PLAN VIEW)
	FLOOR DRAIN / FUNNEL FLOOR DRAIN (ELEVATION)
	ROOF SUMP
CO	CLEAN OUT (IN FLOOR)
CO	CLEAN OUT (IN LINE)
WCO	CLEAN OUT (WALL)
BFP	BACKFLOW PREVENTER
M	WATER METER ASSEMBLY
	HOSE BIBB, WALL HYDRANT
	DIRECTION OF PIPE PITCH
	SPRINKLER HEAD (UPRIGHT)
	SPRINKLER HEAD (SIDEWALL)
FS	FLOW SWITCH
	SIAMESE CONNECTION (YARD)
	SIAMESE CONNECTION (WALL MOUNTED)
	FIRE HYDRANT
	FLOW MEASURING DEVICE
	BALANCING VALVE
	COMBINATION FLOW MEASURING AND BALANCING DEVICE
AAV	AUTOMATIC AIR VALVE
MAV	MANUAL AIR VALVE

MECHANICAL SYMBOLS

ABBREV.	DESCRIPTION
	RECTANGULAR TAKE-OFF (SINGLE LINE)
	RECTANGULAR TAKE-OFF (DOUBLE LINE)
	ROUND TAKE-OFF (SINGLE LINE)
	ROUND TAKE-OFF (DOUBLE LINE)
	SPIN-IN FITTING (WITH VOLUME DAMPER)
	ELBOW (WITH TURNING VANES)
	RADIUS RECTANGULAR ELBOW
	RADIUS ROUND ELBOW
	RECTANGULAR ELBOW UP
	ROUND ELBOW UP
	RECTANGULAR ELBOW DOWN
	ROUND ELBOW DOWN
	CONCENTRIC TRANSITION (DOUBLE LINE)
	CONCENTRIC TRANSITION (SINGLE LINE)
	ECCENTRIC TRANSITION (DOUBLE LINE)
	ECCENTRIC TRANSITION (SINGLE LINE)
R	INCLINED RISE IN DIRECTION OF AIR FLOW (DOUBLE LINE)
R	INCLINED RISE IN DIRECTION OF AIR FLOW (SINGLE LINE)
D	INCLINED DROP IN DIRECTION OF AIR FLOW (DOUBLE LINE)
D	INCLINED DROP IN DIRECTION OF AIR FLOW (SINGLE LINE)
	FLEXIBLE CONNECTION
	FLEXIBLE DUCT CONNECTION TO SUPPLY DIFFUSER
	SUPPLY DIFFUSER
	LINEAR SLOT DIFFUSER
	RETURN OR EXHAUST GRILLE
	TRANSFER GRILLE
	CROSS SECTION OF SUPPLY AIR DUCT
	CROSS SECTION OF EXHAUST OR RETURN AIR DUCT
	EXISTING / NEW — FIRE DAMPER (HORIZONTAL)
	EXISTING / NEW — FIRE DAMPER (VERTICAL)
	EXISTING / NEW — SMOKE DAMPER
	EXISTING / NEW — COMBINATION FIRE/SMOKE DAMPER (VERTICAL)
	EXISTING / NEW — COMBINATION FIRE/SMOKE DAMPER (HORIZONTAL)
	VOLUME DAMPER (MANUALLY ADJUSTABLE)
M	MOTORIZED DAMPER
SD	SMOKE DETECTOR
CO2	CO2 SENSOR
T	THERMOSTAT OR TEMPERATURE SENSOR
H	HUMIDISTAT OR HUMIDITY SENSOR
	RETURN OR EXHAUST AIR FLOW / SUPPLY AIR FLOW

PIPING LEGEND

ABBREV.	DESCRIPTION
BCW	BOOSTED DOMESTIC COLD WATER PIPING
DI	DEIONIZED WATER PIPING
CW	DOMESTIC COLD WATER PIPING
NPCW	NON POTABLE COLD WATER PIPING
RO	REVERSE OSMOSIS WATER PIPING
SCW	SOFTENED COLD WATER
HW	DOMESTIC HOT WATER PIPING
HWR	DOMESTIC HOT WATER RECIRCULATION PIPING
NPHW	NON POTABLE HOT WATER PIPING
TW	TEMPERED WATER PIPING
F (DRY)	FIRE PROTECTION DRY PIPING
F	FIRE PROTECTION WET PIPING
F (PRE)	FIRE PROTECTION PRE-ACTION PIPING
CHWR	CHILLED WATER RETURN PIPING
CWR	CONDENSER WATER RETURN PIPING
GXHR	GEO HEAT EXCHANGE RETURN PIPING
HPLR	HEAT PUMP LOOP RETURN PIPING
HHWR	HEATING HOT WATER RETURN PIPING
HPC	HIGH PRESSURE CONDENSATE RETURN PIPING
LPC	LOW PRESSURE CONDENSATE RETURN PIPING
RHWR	RADIANT HEATING WATER RETURN PIPING
PCR	STEAM CONDENSATE PUMPED RETURN PIPING
CR	STEAM CONDENSATE RETURN PIPING
CHWS	CHILLED WATER SUPPLY PIPING
CA	COMPRESSED AIR PIPING
CWS	CONDENSER WATER SUPPLY PIPING
GXHS	GEO HEAT EXCHANGE SUPPLY PIPING
HPLS	HEAT PUMP LOOP SUPPLY PIPING
HHWS	HEATING HOT WATER SUPPLY PIPING
HPS	HIGH PRESSURE STEAM PIPING
LPS	LOW PRESSURE STEAM PIPING
G	NATURAL GAS PIPING
RHWS	RADIANT HEATING WATER SUPPLY PIPING
STM	STEAM PIPING
R	REFRIGERANT PIPING
RL	REFRIGERANT LIQUID PIPING
RS	REFRIGERANT SUCTION PIPING
AW	ACID WASTE PIPING
CD	CONDENSATE DRAIN PIPING
PCD	CONDENSATE DRAIN PUMPED PIPING
DT	DRAIN TILE
GW	GREASE WASTE PIPING
IW	INDUSTRIAL WASTE PIPING
RC	RAIN CONDUCTOR PIPING
ORC	RAIN CONDUCTOR OVERFLOW PIPING
SAN	SANITARY PIPING
PSAN	SANITARY PUMPED PIPING
ST	STORM PIPING
PST	STORM PUMPED PIPING
AV	ACID VENT PIPING
V	VENT PIPING
MV	MEDICAL VACUUM PIPING
VAC	VACUUM PIPING
WAGD	WASTE ANESTHESIA GAS DISPOSAL PIPING
CO2	CARBON DIOXIDE PIPING
H	HELIUM PIPING
IA	INSTRUMENT AIR PIPING
MA	MEDICAL AIR PIPING
N	NITROGEN PIPING
NO	NITROUS OXIDE PIPING
O2	OXYGEN PIPING
OTHER	OTHER PIPING

APPLICABLE CODES AND REGULATIONS

YEAR	CODE
2015	MICHIGAN BUILDING CODE
2018	MICHIGAN PLUMBING CODE
2015	MICHIGAN MECHANICAL CODE
2015	MICHIGAN UNIFORM ENERGY CODE
2015	INTERNATIONAL FIRE CODE
2015	INTERNATIONAL FUEL GAS CODE
2014	NFPA 96
2013	NFPA 13
2012	NFPA 101 WITH BFS AMENDMENTS
2009	ICC/ANSI ACCESSIBLE AND USABLE BUILDING & FACILITIES
-	AMERICANS WITH DISABILITIES ACT ACCESSIBILITIES GUIDELINE (ADA-AG)

DRAWING INDEX

SHEET NO	DESCRIPTION
M0.0	MECHANICAL GENERAL INFORMATION
FP1.1A	FIRE PROTECTION PLAN - UNIT 100A
FP1.2	FIRE PROTECTION PLAN - UNIT 200
FP1.3	FIRE PROTECTION PLAN - UNIT 300
FP1.4	FIRE PROTECTION PLAN - UNIT 400
P1.1UGA	UNDERGROUND PLUMBING PLAN - UNIT 100A
P1.2UG	UNDERGROUND PLUMBING PLAN - UNIT 200
P1.3UG	UNDERGROUND PLUMBING PLAN - UNIT 300
P1.4UG	UNDERGROUND PLUMBING PLAN - UNIT 400
P1.1A	PLUMBING PLAN - UNIT 100A
P1.2	PLUMBING PLAN - UNIT 200
P1.3	PLUMBING PLAN - UNIT 300
P1.4	PLUMBING PLAN - UNIT 400
P4.0	ENLARGED KITCHEN PLUMBING PLANS
P4.1	ENLARGED PLUMBING PLANS
P5.0	PLUMBING DETAILS
P6.0	PLUMBING SCHEDULES
MH1.1A	MECHANICAL HVAC PLAN - UNIT 100A
MH1.2	MECHANICAL HVAC PLAN - UNIT 200
MH1.3	MECHANICAL HVAC PLAN - UNIT 300
MH1.4	MECHANICAL HVAC PLAN - UNIT 400
MP1.1A	MECHANICAL PIPING PLAN - UNIT 100A
MP1.2	MECHANICAL PIPING PLAN - UNIT 200
MP1.3	MECHANICAL PIPING PLAN - UNIT 300
MP1.4	MECHANICAL PIPING PLAN - UNIT 400
M1.11A	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 100A
M1.12	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 200
M1.13	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 300
M1.14	ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 400
M5.0	MECHANICAL DETAILS
M6.0	MECHANICAL SCHEDULES
M6.1	MECHANICAL SCHEDULES
M6.2	MECHANICAL SCHEDULES
M7.0	MECHANICAL RISER DIAGRAMS
M8.0	CONTROL DIAGRAMS
M8.1	CONTROL DIAGRAMS
M8.2	CONTROL DIAGRAMS
M8.3	CONTROL DIAGRAMS
M8.4	CONTROL DIAGRAMS
GHX1.0	GEOTHERMAL SITE PLAN
GHX5.0	GEOTHERMAL DETAILS

DRAWING NOTATION

SYMBOL	DESCRIPTION
1	NEW WORK KEY NOTE NO. 1
EF-1	EQUIPMENT DESIGNATION, (IE: EXHAUST FAN NO. 1)
S-1 8ø 100-2	AIR TERMINAL TAG: IE: DIFFUSER TYPE = S-1; NECK SIZE = 8ø; CFM = 100-(TYPICAL FOR 2) — S = SUPPLY; R = RETURN; E = EXHAUST; T = TRANSFER
	NEW OR MODIFIED DEVICES OR EQUIPMENT
	NEW PIPING UNDERGROUND
4 / M5.2	SECTION NO. 4; SHEET M5.2 ON WHICH SECTION IS DRAWN
6 / M5.2	SECTION NO. 6; **SECTION** SCALE: 1/4" = 1' - 0"; SHEET M5.2 ON WHICH SECTION IS CUT (ENLARGED PARTIAL PLAN SIMILAR)

WATER FLOW TEST DATA

DATE PERFORMED	REPORTED PRESSURES	
	STATIC	RESIDUAL
08-18-2023	66 PSI @ 856 GPM	54 PSI @ 856 GPM

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
MECHANICAL GENERAL INFORMATION

SHEET NO.
M0.0

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HVAC KEYNOTES

H1 ROUTE Ø20 EA DUCT UP THROUGH ROOF IN WEATHER TIGHT ENCLOSURE. TERMINATE WITH GOOSE NECK MINIMUM 18" ABOVE ROOF. PROVIDE WITH BIRD SCREEN.
H2 FOR SUPPLY AND EXHAUST DUCTWORK SERVING SHOWER ROOMS, PROVIDE ALUMINUM SHEET METAL SOLDERED WATER TIGHT AND PITCHED TO LAST REGISTER. PROVIDED PITCH DRAIN IN DUCTWORK AT LOW POINT.
H3 GRILLES MOUNTED AT 22". REFER TO DETAIL.
H4 GRILLES MOUNTED AT 45°. REFER TO DETAIL.
H5 ROUTE 8"Ø OA DUCT UP THROUGH ROOF IN WEATHER TIGHT ENCLOSURE. TERMINATE WITH GOOSE NECK MINIMUM 18" ABOVE ROOF. PROVIDE WITH BIRD SCREEN.
H6 KITCHEN VENTILATION HOOD BY FSEC. COORDINATE DUCTWORK SIZES AND CONNECTION WITH HOOD MFR.
H7 CONNECT DISHWASHER EXHAUST DUCTWORK TO COLLAR ON DISHWASHER (BY FSEC). PROVIDE 18 GA. STAINLESS STEEL WELDED DUCTWORK. PROVIDE STAINLESS STEEL TRIM COLLAR AT CEILING.
H8 PITCH DUCTWORK TO DISHWASHER CONNECTION. PROVIDE PITCHED DRAIN IN DUCTWORK AT LOW POINT.
H9 90X24" RA ELBOW DOWN ALONG WALL. FINISH WITH BELLMOUTH OPENING AND BIRD SCREEN APPROX 15'-0" A.F.F.
H10 LINE FIRST 10 FT OF SUPPLY AIR DUCTWORK OUT OF THE VUV. REFER TO SPECS FOR FURTHER INFO.
H11 RACK AND ROUTE REFRIGERANT PIPING AND ELECTRICAL CONDUIT FROM CONDENSING UNIT ON ROOF TO ASSOCIATED FAN COIL UNIT. MOUNT EQUIPMENT ON RAILS OR CURB, 14" MIN. COORDINATE WITH ARCHITECTURAL/ROOFING TRADES. ROUTE REFRIGERANT PIPING THROUGH ROOF IN WEATHER TIGHT ENCLOSURE.
H12 PROVIDE GALVANEALED DUCTWORK AND PAINT TO MATCH ARCHITECTURAL FINISH. COORDINATE COLOR WITH ARCHITECTURE.
H13 4" DRYER EXHAUST. PROVIDE DRYER TERMINATION CAP IN SIDE WALL OF ROOF CURB. TERMINATE IN ROOF CURB SIMILAR TO PIPE CURB DETAIL; REFER TO DETAIL SHEETS. FOLLOW ALL MANUFACTURER GUIDELINES FOR EXHAUST ROUTING AND TERMINATION.
H14 BMS CONTROLLER. COORDINATE LOCATION WITH CONTROLS CONTRACTOR AND ELECTRICAL CONTRACTOR. CONTROLS CONTRACTOR TO COORDINATE QUANTITIES.

PLUMBING GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC & INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE PLUMBING SYSTEMS COMPLETE AND PER APPLICABLE CODES INCLUDING REQUIRED COMPONENTS, OFFSETS REQUIRED TO AVOID THE STRUCTURE, ETC.
2. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHT OF ALL PLUMBING FIXTURES, BOTH STANDARD AND BARRIER FREE. REFER TO PLUMBING FIXTURE SCHEDULE FOR FIXTURE TYPES, BRANCH CONNECTION SIZES AND ADDITIONAL REQUIREMENTS.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH THE STATE AND LOCAL COUNTY DEPARTMENT OF HEALTH CROSS CONTAMINATION CODE REQUIREMENTS.
4. VERIFY DEPTH, SIZE, LOCATION AND CONDITION OF ALL UTILITIES IN THE FIELD, INCLUDING POINTS OF CONNECTION, PRIOR TO STARTING ANY WORK. NOTIFY THE ARCHITECT/ENGINEER OF ANY INTERFERENCES OR DISCREPANCIES.
5. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF PLUMBING AND PIPING WORK WITH THE WORK OF ALL OTHER TRADES, EXISTING SITE CONDITIONS, AND EQUIPMENT MANUFACTURER RECOMMENDATIONS. VERIFY ALL CLEARANCES PRIOR TO THE FABRICATION OF ANY NEW WORK.
6. PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL MAINTAIN REQUIRED CLEARANCES OVER, AROUND AND IN FRONT OF ALL ELECTRICAL EQUIPMENT, PANELS, TRANSFORMERS, ETC. PIPING SHALL NOT INTERFERE WITH, OR BE INSTALLED IN A LOCATION THAT RESTRICTS ACCESS OR CLEARANCE TO ELECTRICAL OR MECHANICAL DEVICES. PROVIDE REQUIRED ACCESS AND CLEARANCE AROUND ALL EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS.

PLUMBING GENERAL NOTES

7. CONTRACTOR SHALL PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL PLUMBING SYSTEMS.
8. PROVIDE BRANCH LINE ISOLATION VALVES ON DOMESTIC PIPING TO EACH GROUP OF FIXTURES AND TOILET ROOMS.
9. PLUMBING VENT PIPING THRU THE ROOF SHALL BE LOCATED 10'-0" FROM ANY FRESH AIR INTAKE LOCATION AND A MINIMUM OF 18" CLEAR FROM THE INSIDE FACE OF PARAPET.
10. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR VALVES/CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. PROVIDE CLEANOUTS AT THE BASE OF ALL STACKS.
11. RUN ALL SANITARY AND STORM PIPING 2 1/2" OR LESS AT 1/4" PER FOOT AND 3" AND LARGER PIPING AT 1/8" PER FOOT MINIMUM UNLESS OTHERWISE NOTED. MINIMUM UNDERGROUND PIPE SIZE SHALL BE 3".
12. PROVIDE "INLINE" TRAP SEAL PROTECTION OR TRAP PRIMER ON ALL FLOOR DRAINS AND TRAPS SUBJECT TO EVAPORATION.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.

HVAC GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE HVAC SYSTEMS COMPLETE PER SPECIFICATION, SMACNA STANDARDS, AND PER APPLICABLE CODES INCLUDING ALL NECESSARY OFFSETS, FITTINGS, SPECIAL RADIUS OR MITERED ELBOWS WHICH ARE REQUIRED DUE TO SPACE CONSTRAINTS OR STRUCTURAL CONDITIONS OR OTHER CONDITIONS.
2. CONTRACTOR SHALL COORDINATE THEIR WORK WITH THE WORK OF ALL OTHER TRADES. ALL DUCTWORK IS TO BE ROUTED AS HIGH AS POSSIBLE. PROVIDE ACCESS AROUND ALL NEW EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL CLEARANCES PRIOR TO THE FABRICATION OF ANY WORK.
3. DUCTWORK/PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL NOT BE LOCATED OVER ELECTRICAL EQUIPMENT/PANELS. PROVIDE REQUIRED CLEARANCE IN FRONT OF ELECTRICAL EQUIPMENT. DUCTWORK/PIPING SHALL NOT INTERFERE WITH ELECTRICAL EQUIPMENT CLEARANCE.
4. DUCTWORK/PIPING SHALL NOT BE INSTALLED IN A LOCATION THAT RESTRICTS THE ACCESS TO MECHANICAL DEVICES REQUIRING ACCESS.
5. THE CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS SUPPORTING STEEL, ETC. FOR THE PROPER INSTALLATION OF ALL MECHANICAL SYSTEMS.
6. COORDINATE FLOOR, WALL, ROOF PENETRATIONS, LOUVER SIZES, PAD LOCATIONS ETC. WITH ARCHITECTURAL TRADES. SEAL ALL PIPING AND DUCT PENETRATIONS.
7. THE CONTRACTOR SHALL REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF GRILLES, REGISTERS, AND DIFFUSERS.

HVAC GENERAL NOTES

8. COORDINATE AND PROVIDE ACCESS DOORS IN HARD CEILING AREAS FOR ACCESS TO BALANCING DAMPERS, ETC. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
9. BRANCH DUCTWORK TO GRILLES, REGISTERS AND DIFFUSERS SHALL BE THE SAME SIZE AS THE GRILLE, REGISTER OR DIFFUSER NECK SIZE WHERE NO DUCT SIZE IS INDICATED ON PLAN.
10. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL BE 5'-0".
11. FOR EQUIPMENT VALVING, COMPONENT, AND PIPING ARRANGEMENT, REFER TO PIPING DIAGRAMS AND DETAILS.
12. PAINT ALL VISIBLE INTERIOR SURFACES OF EXHAUST/RETURN GRILLES, REGISTERS AND VISIBLE ASSOCIATED DUCTWORK FLAT BLACK.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
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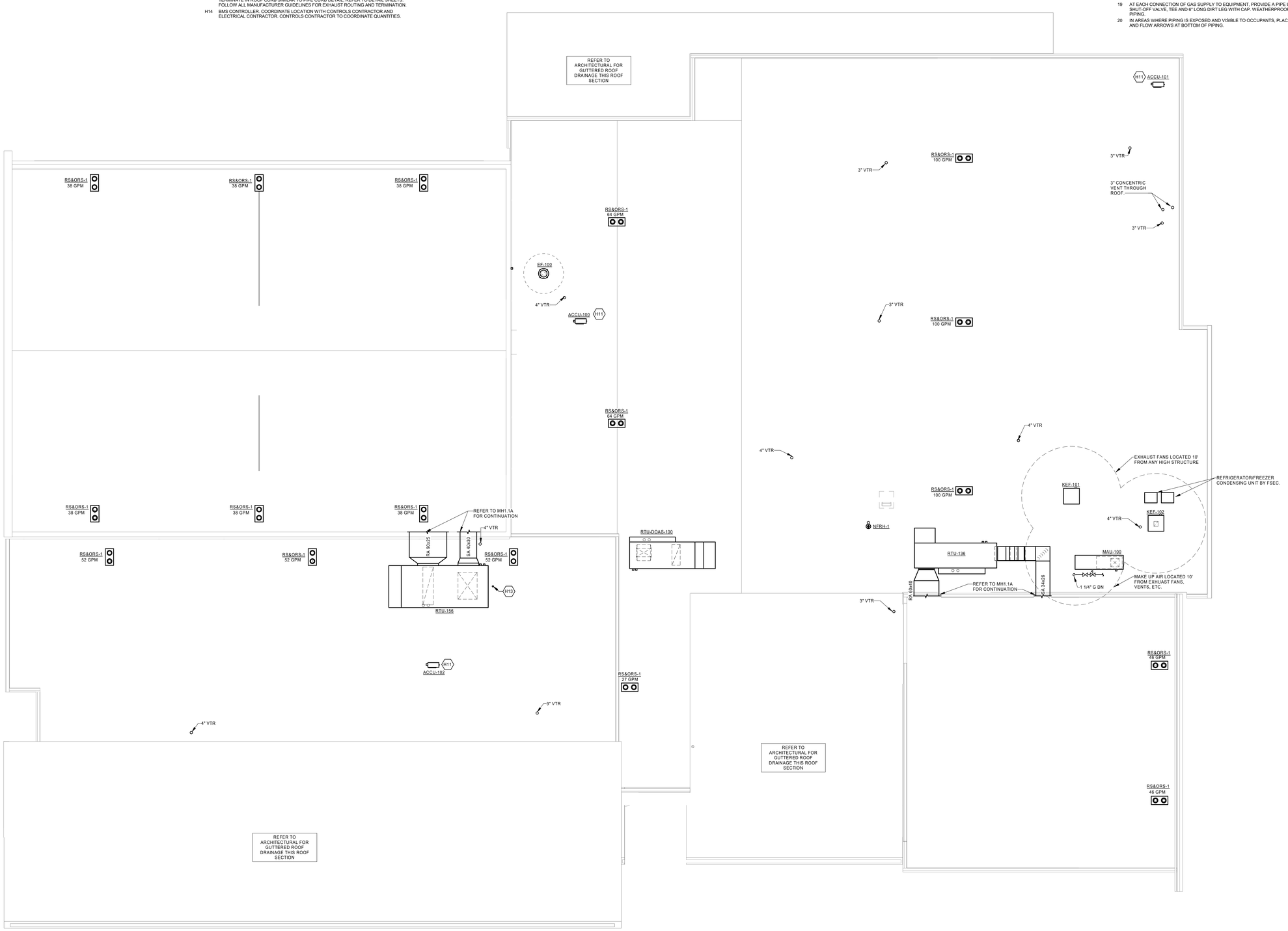
15. DUCTWORK TO AND FROM VAV BOXES/TERMINAL UNITS SHALL BE EQUAL TO THE BOX CONNECTIONS SIZES UNLESS INDICATED OTHERWISE.
16. CONNECTION TO EQUIPMENT SHALL BE VERIFIED WITH MANUFACTURER'S CERTIFIED DRAWINGS. TRANSITIONS TO ALL EQUIPMENT SHALL BE VERIFIED AND PROVIDED FOR EQUIPMENT FURNISHED.
17. ALL BRANCH PIPING TO TERMINAL UNITS TO BE 3/4" UNLESS OTHERWISE NOTED.
18. AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT PROVIDE A UNION, SHUT-OFF VALVE, TEE WITH SEDIMENT TRAP & PRESSURE TEST PLUG, REGULATOR AND UNION. FOR MEDIUM PRESSURE REGULATORS, AN ADDITIONAL TEE WITH PRESSURE TEST PLUG SHALL BE INSTALLED NOT LESS THAN 10 PIPE DIAMETERS DOWNSTREAM. SEDIMENT TRAPS SHALL BE INSTALLED SUCH THAT THERE IS ROOM BELOW TO REMOVE THE CAP/PLUG AND CLEAN THE TRAP. WEATHERPROOF PAINT ALL EXTERIOR GAS PIPING.
19 AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT, PROVIDE A PIPE UNION, GAS SHUT-OFF VALVE, TEE AND 6" LONG DIRT LEG WITH CAP. WEATHERPROOF PAINT ALL GAS PIPING.
20 IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.



ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

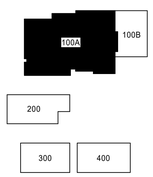
Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN R. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 100A

SHEET NO.
M1.11A

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HVAC KEYNOTES

H1 ROUTE 6"Ø EA DUCT UP THROUGH ROOF IN WEATHER TIGHT ENCLOSURE. TERMINATE WITH GOOSE NECK MINIMUM 18" ABOVE ROOF. PROVIDE WITH BIRD SCREEN.

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H7 CONNECT DISHWASHER EXHAUST DUCTWORK TO COLLAR ON DISHWASHER (BY FSEC). PROVIDE 18 GA. STAINLESS STEEL WELDED DUCTWORK. PROVIDE STAINLESS STEEL TRIM COLLAR AT CEILING.

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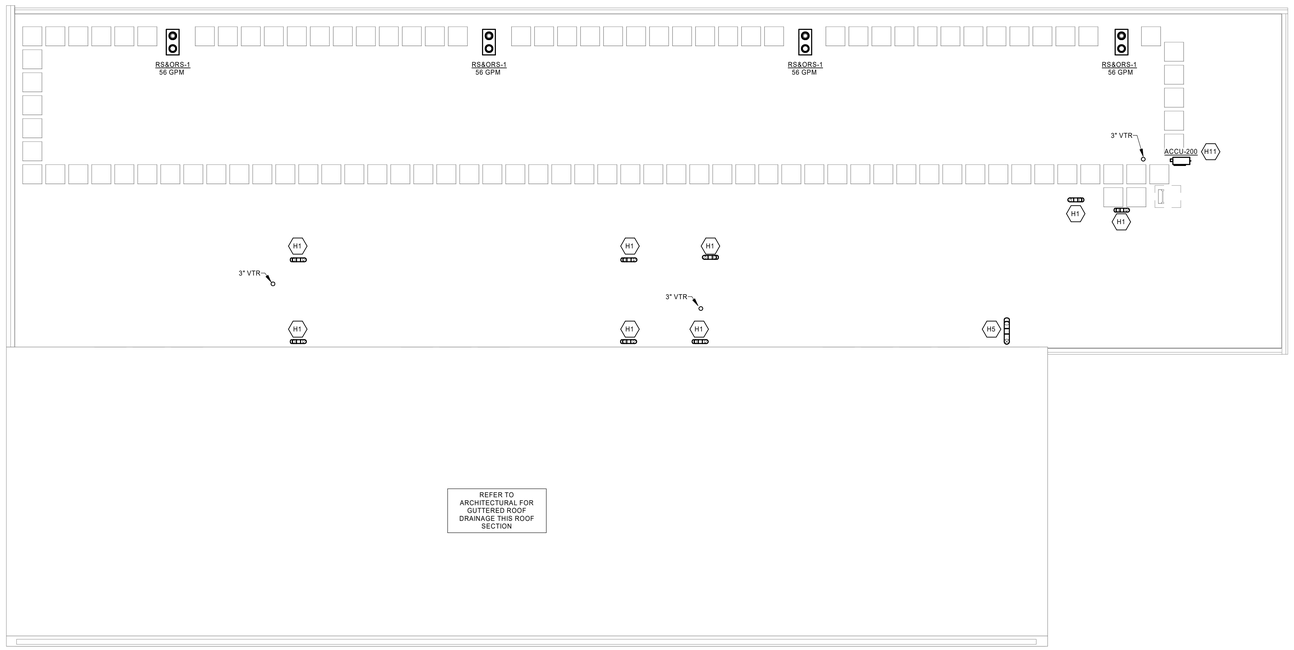
3. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH THE STATE AND LOCAL COUNTY DEPARTMENT OF HEALTH CROSS CONTAMINATION CODE REQUIREMENTS.
4. VERIFY DEPTH, SIZE, LOCATION AND CONDITION OF ALL UTILITIES IN THE FIELD, INCLUDING POINTS OF CONNECTION, PRIOR TO STARTING ANY WORK. NOTIFY THE ARCHITECT/ENGINEER OF ANY INTERFERENCES OR DISCREPANCIES.
5. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF PLUMBING AND PIPING WORK WITH THE WORK OF ALL OTHER TRADES, EXISTING SITE CONDITIONS, AND EQUIPMENT MANUFACTURER RECOMMENDATIONS. VERIFY ALL CLEARANCES PRIOR TO THE FABRICATION OF ANY NEW WORK.
6. PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL MAINTAIN REQUIRED CLEARANCES OVER, AROUND AND IN FRONT OF ALL ELECTRICAL EQUIPMENT, PANELS, TRANSFORMERS, ETC. PIPING SHALL NOT INTERFERE WITH, OR BE INSTALLED IN A LOCATION THAT RESTRICTS ACCESS OR CLEARANCE TO ELECTRICAL OR MECHANICAL DEVICES. PROVIDE REQUIRED ACCESS AND CLEARANCE AROUND ALL EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS.
7. CONTRACTOR SHALL PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL PLUMBING SYSTEMS.
8. PROVIDE BRANCH LINE ISOLATION VALVES ON DOMESTIC PIPING TO EACH GROUP OF FIXTURES AND TOILET ROOMS.
9. PLUMBING VENT PIPING THRU THE ROOF SHALL BE LOCATED 10'-0" FROM ANY FRESH AIR INTAKE LOCATION AND A MINIMUM OF 18" CLEAR FROM THE INSIDE FACE OF PARAPET.
10. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR VALVES/CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. PROVIDE CLEANOUTS AT THE BASE OF ALL STACKS.
11. RUN ALL SANITARY AND STORM PIPING 2 1/2" OR LESS AT 1/4" PER FOOT AND 3" AND LARGER PIPING AT 1/8" PER FOOT MINIMUM UNLESS OTHERWISE NOTED. MINIMUM UNDERGROUND PIPE SIZE SHALL BE 3".
12. PROVIDE "INLINE" TRAP SEAL PROTECTION OR TRAP PRIMER ON ALL FLOOR DRAINS AND TRAPS SUBJECT TO EVAPORATION.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.



ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 200

SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 200

SHEET NO.

M1.12

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HVAC KEYNOTES

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H2 FOR SUPPLY AND EXHAUST DUCTWORK SERVING SHOWER ROOMS, PROVIDE ALUMINUM SHEET METAL SOLDERED WATER TIGHT AND PITCHED TO LAST REGISTER. PROVIDED PITCH DRAIN IN DUCTWORK AT LOW POINT.

H3 GRILLES MOUNTED AT 22". REFER TO DETAIL.

H4 GRILLES MOUNTED AT 45°. REFER TO DETAIL.

H5 ROUTE 8"Ø OA DUCT UP THROUGH ROOF IN WEATHER TIGHT ENCLOSURE. TERMINATE WITH GOOSE NECK MINIMUM 18" ABOVE ROOF. PROVIDE WITH BIRD SCREEN.

H6 KITCHEN VENTILATION HOOD BY FSEC. COORDINATE DUCTWORK SIZES AND CONNECTION WITH HOOD MFR.

H7 CONNECT DISHWASHER EXHAUST DUCTWORK TO COLLAR ON DISHWASHER (BY FSEC). PROVIDE 18 GA. STAINLESS STEEL WELDED DUCTWORK. PROVIDE STAINLESS STEEL TRIM COLLAR AT CEILING.

H8 PITCH DUCTWORK TO DISHWASHER CONNECTION. PROVIDE PITCHED DRAIN IN DUCTWORK AT LOW POINT.

H9 90X24" RA ELBOW DOWN ALONG WALL. FINISH WITH BELLMOUTH OPENING AND BIRD SCREEN APPROX 15'-0" A.F.F.

H10 LINE FIRST 10 FT OF SUPPLY AIR DUCTWORK OUT OF THE VUV. REFER TO SPECS FOR FURTHER INFO.

H11 RACK AND ROUTE REFRIGERANT PIPING AND ELECTRICAL CONDUIT FROM CONDENSING UNIT ON ROOF TO ASSOCIATED FAN COIL UNIT. MOUNT EQUIPMENT ON RAILS OR CURB, 14" MIN. COORDINATE WITH ARCHITECTURAL/ROOFING TRADES. ROUTE REFRIGERANT PIPING THROUGH ROOF IN WEATHER TIGHT ENCLOSURE.

H12 PROVIDE GALVANEALED DUCTWORK AND PAINT TO MATCH ARCHITECTURAL FINISH. COORDINATE COLOR WITH ARCHITECTURE.

H13 4" DRYER EXHAUST. PROVIDE DRYER TERMINATION CAP IN SIDE WALL OF ROOF CURB. TERMINATE IN ROOF CURB SIMILAR TO PIPE CURB DETAIL. REFER TO DETAIL SHEETS. FOLLOW ALL MANUFACTURER GUIDELINES FOR EXHAUST ROUTING AND TERMINATION.

H14 BMS CONTROLLER. COORDINATE LOCATION WITH CONTROLS CONTRACTOR AND ELECTRICAL CONTRACTOR. CONTROLS CONTRACTOR TO COORDINATE QUANTITIES.

HVAC GENERAL NOTES

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2. CONTRACTOR SHALL COORDINATE THEIR WORK WITH THE WORK OF ALL OTHER TRADES. ALL DUCTWORK IS TO BE ROUTED AS HIGH AS POSSIBLE. PROVIDE ACCESS AROUND ALL NEW EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL CLEARANCES PRIOR TO THE FABRICATION OF ANY WORK.
3. DUCTWORK/PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL NOT BE LOCATED OVER ELECTRICAL EQUIPMENT/PANELS. PROVIDE REQUIRED CLEARANCE IN FRONT OF ELECTRICAL EQUIPMENT. DUCTWORK/PIPING SHALL NOT INTERFERE WITH ELECTRICAL EQUIPMENT CLEARANCE.
4. DUCTWORK/PIPING SHALL NOT BE INSTALLED IN A LOCATION THAT RESTRICTS THE ACCESS TO MECHANICAL DEVICES REQUIRING ACCESS.
5. THE CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS SUPPORTING STEEL, ETC. FOR THE PROPER INSTALLATION OF ALL MECHANICAL SYSTEMS.
6. COORDINATE FLOOR, WALL, ROOF PENETRATIONS, LOUVER SIZES, PAD LOCATIONS ETC. WITH ARCHITECTURAL TRADES. SEAL ALL PIPING AND DUCT PENETRATIONS.
7. THE CONTRACTOR SHALL REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF GRILLES, REGISTERS, AND DIFFUSERS.
8. COORDINATE AND PROVIDE ACCESS DOORS IN HARD CEILING AREAS FOR ACCESS TO BALANCING DAMPERS, ETC. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
9. BRANCH DUCTWORK TO GRILLES, REGISTERS AND DIFFUSERS SHALL BE THE SAME SIZE AS THE GRILLE, REGISTER OR DIFFUSER NECK SIZE WHERE NO DUCT SIZE IS INDICATED ON PLAN.
10. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL BE 5'-0".
11. FOR EQUIPMENT VALVING, COMPONENT, AND PIPING ARRANGEMENT, REFER TO PIPING DIAGRAMS AND DETAILS.
12. PAINT ALL VISIBLE INTERIOR SURFACES OF EXHAUST/RETURN GRILLES, REGISTERS AND VISIBLE ASSOCIATED DUCTWORK FLAT BLACK.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR DAMPERS, VALVES, AND CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPES.
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16. CONNECTION TO EQUIPMENT SHALL BE VERIFIED WITH MANUFACTURER'S CERTIFIED DRAWINGS. TRANSITIONS TO ALL EQUIPMENT SHALL BE VERIFIED AND PROVIDED FOR EQUIPMENT FURNISHED.
17. ALL BRANCH PIPING TO TERMINAL UNITS TO BE 3/4" UNLESS OTHERWISE NOTED.
18. AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT PROVIDE A UNION, SHUT-OFF VALVE, TEE WITH SEDIMENT TRAP & PRESSURE TEST PLUG, REGULATOR AND UNION. FOR MEDIUM PRESSURE REGULATORS, AN ADDITIONAL TEE WITH PRESSURE TEST PLUG SHALL BE INSTALLED NOT LESS THAN 10 PIPE DIAMETERS DOWNSTREAM. SEDIMENT TRAPS SHALL BE INSTALLED SUCH THAT THERE IS ROOM BELOW TO REMOVE THE CAP/PLUG AND CLEAN THE TRAP. WEATHERPROOF PAINT ALL EXTERIOR GAS PIPING.
19. AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT, PROVIDE A PIPE UNION, GAS SHUT-OFF VALVE, TEE AND 6" LONG DIRT LEG WITH CAP. WEATHERPROOF PAINT ALL GAS PIPING.
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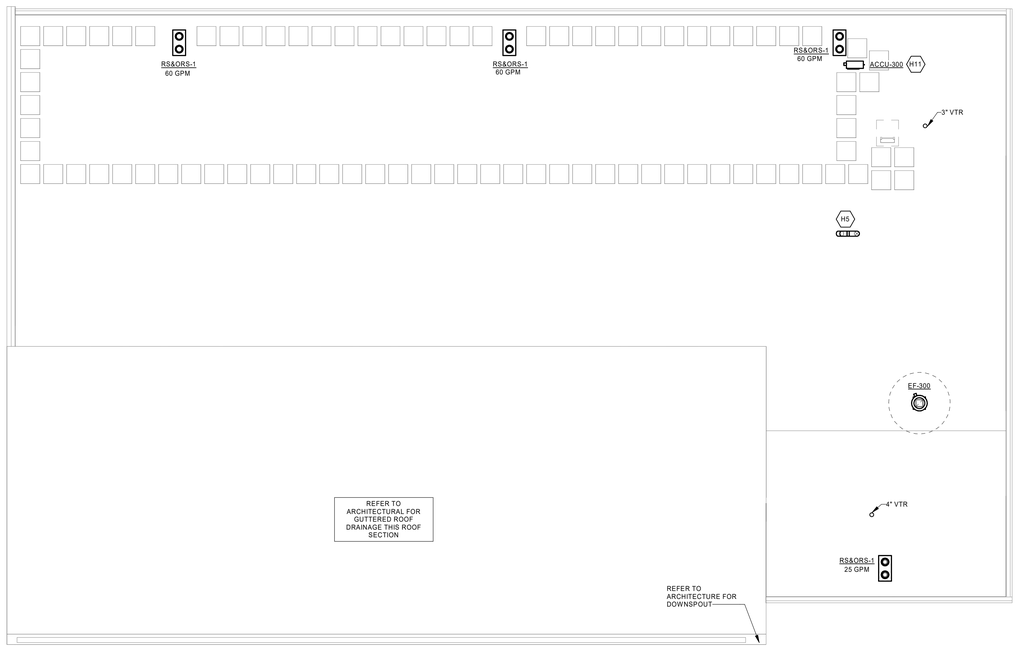


ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

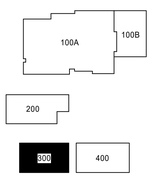
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 300

SHEET NO.
M1.13

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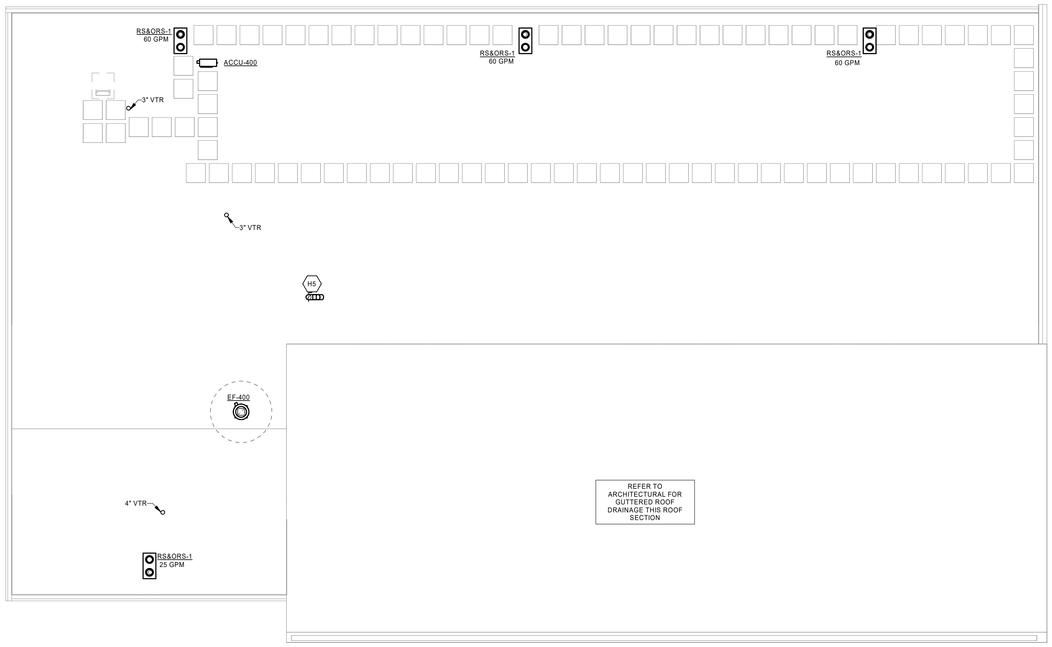

ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 400
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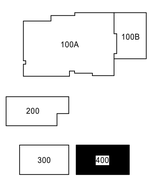
ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

ROOF COMB. MECHANICAL & PLUMBING PLAN - UNIT 400

SHEET NO.

M1.14

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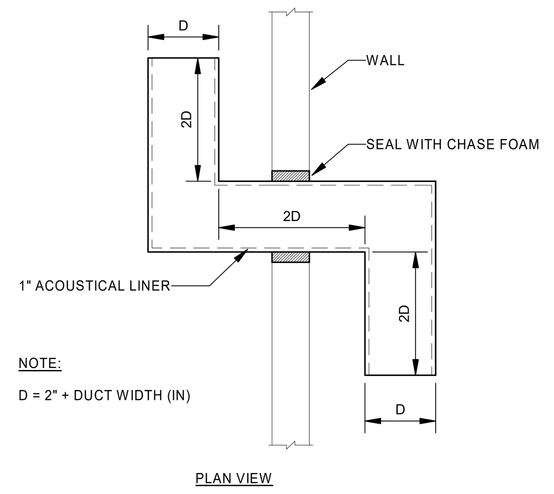
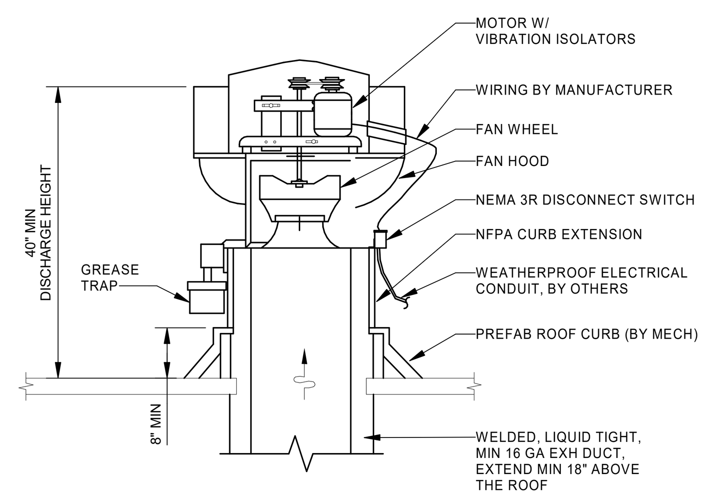


TRANSFER DUCT DETAIL (Z-DUCT)
NO SCALE



EXHAUST FAN- KITCHEN DETAIL
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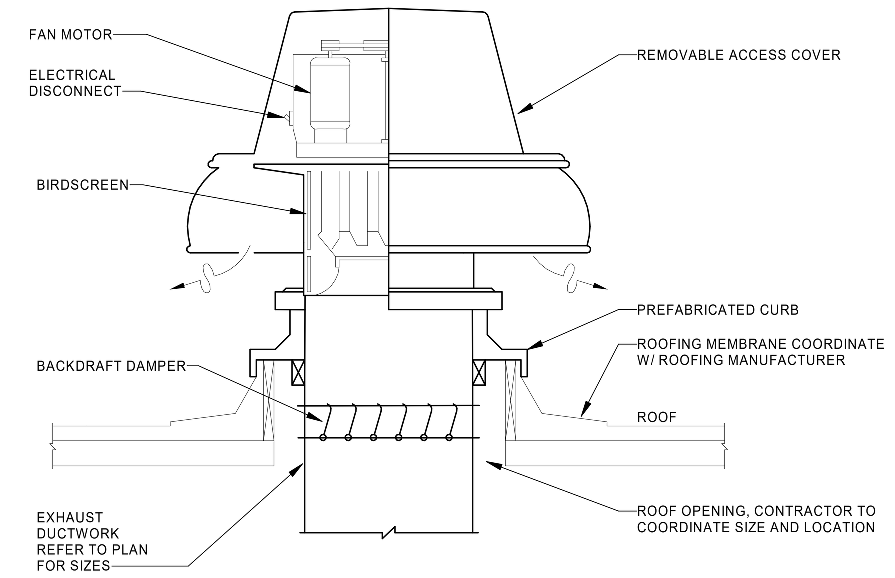
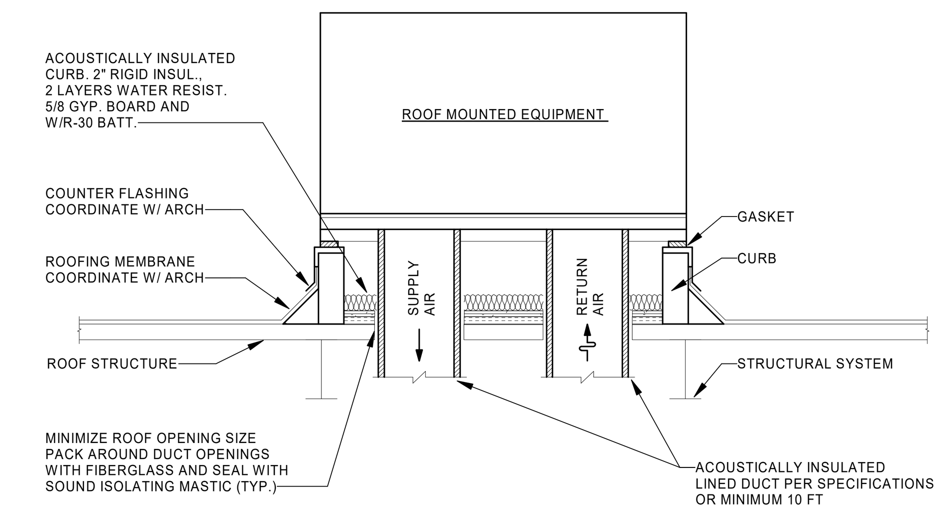
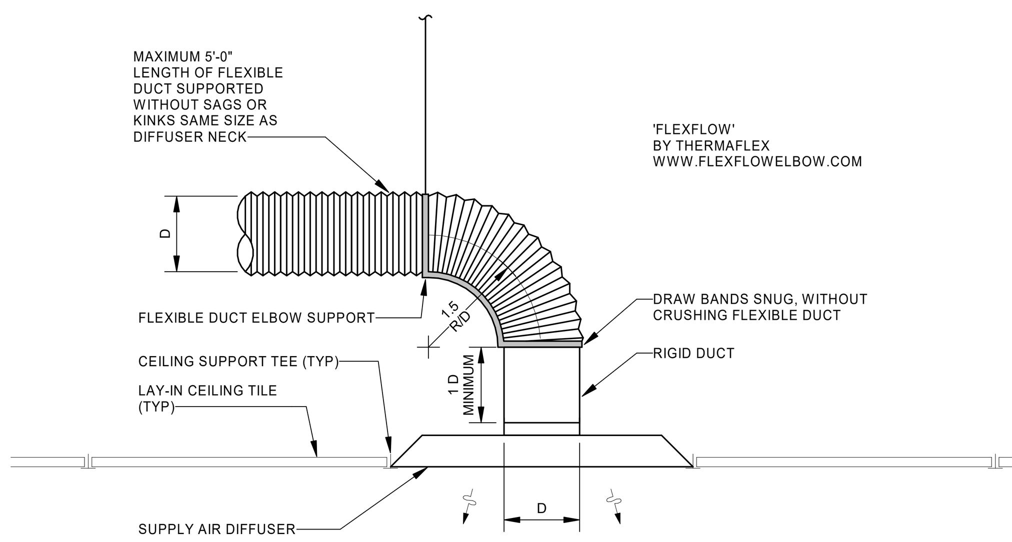


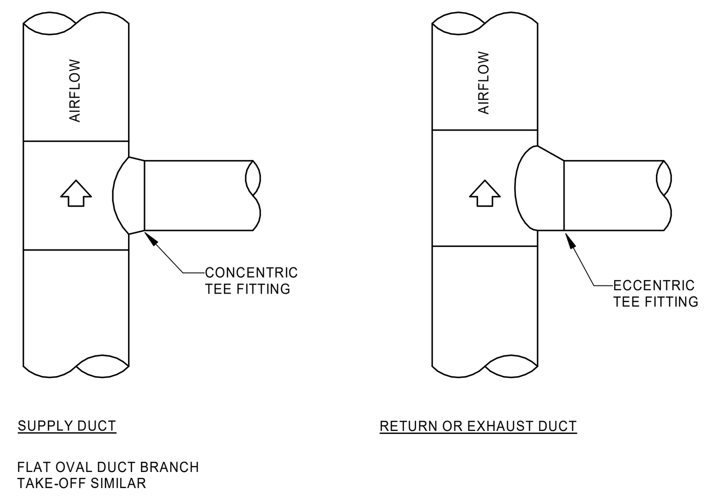
EXHAUST FAN- ROOF MOUNTING DETAIL
NO SCALE



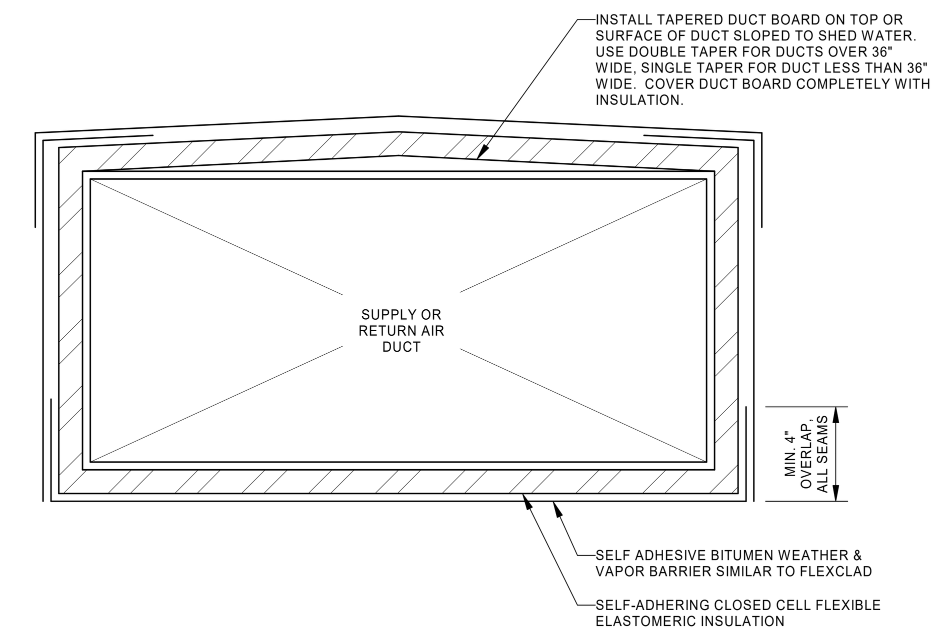
RTU - CURB MOUNTING DETAIL
NO SCALE



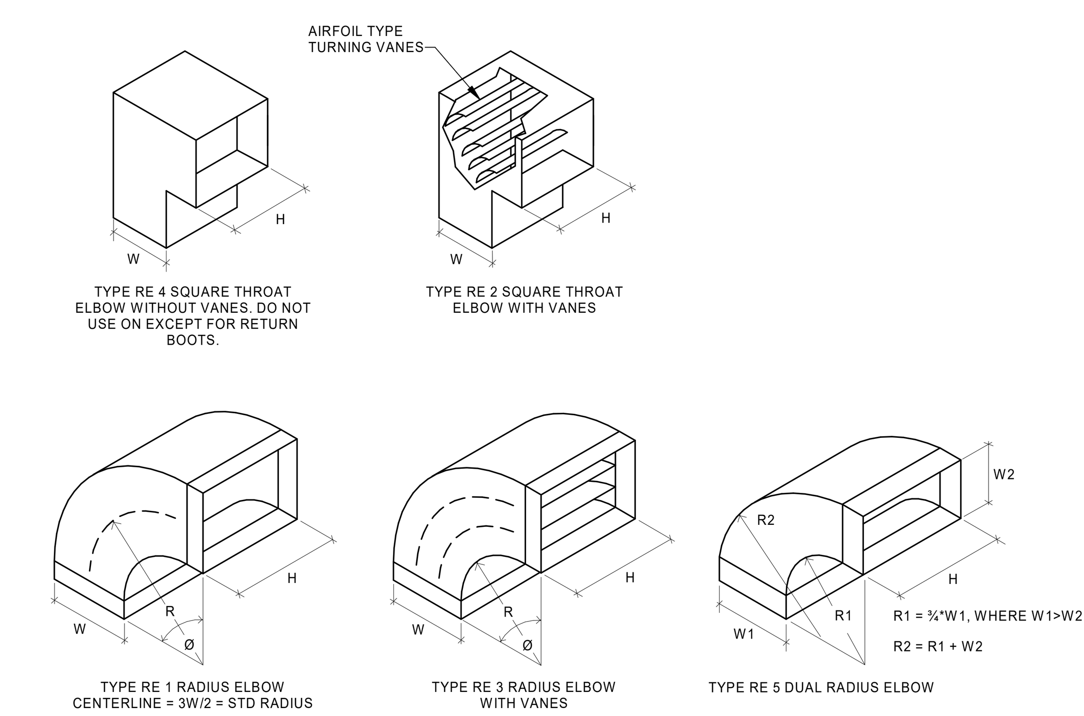
DIFFUSER- SUPPLY AIR DETAIL
NO SCALE



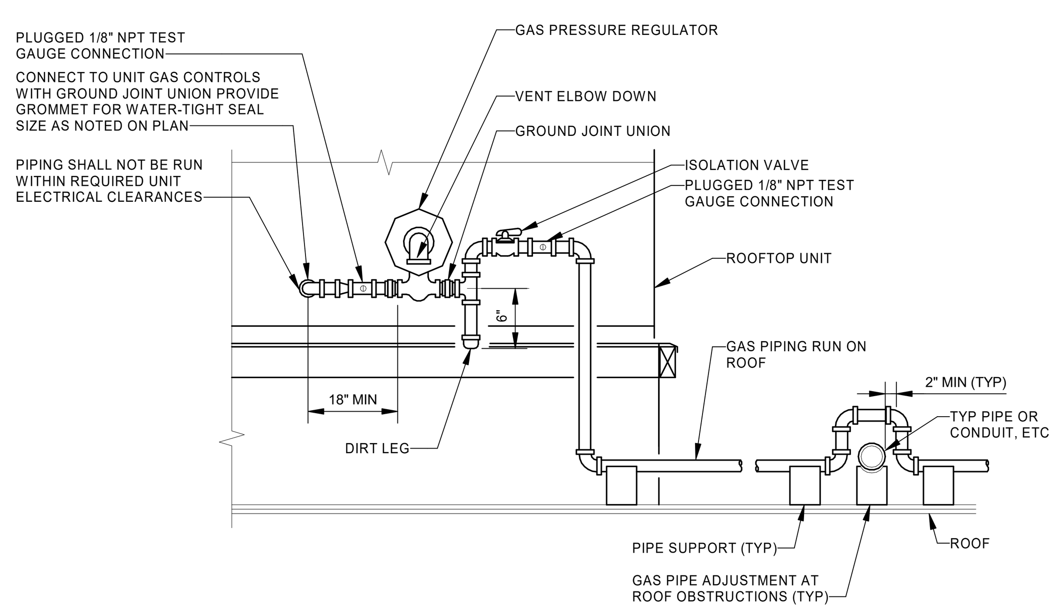
DUCT ROUND BRANCH TAKE-OFF DETAILS
NO SCALE



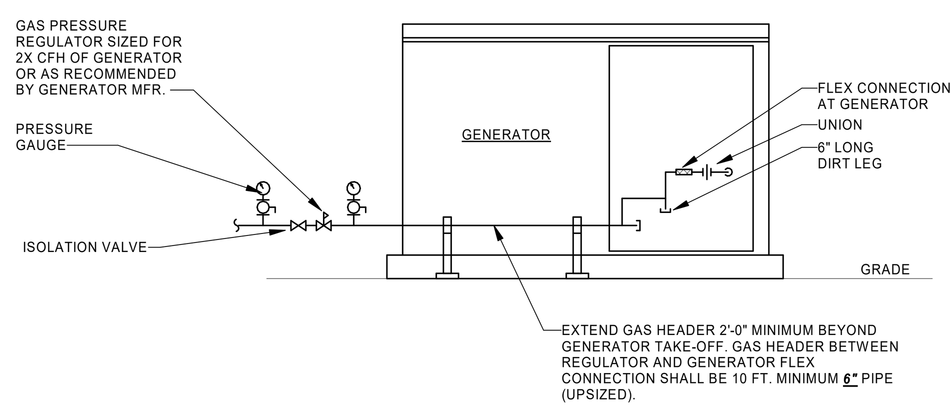
ROOF MOUNTED OR EXTERIOR DUCT INSULATION DETAIL
NO SCALE



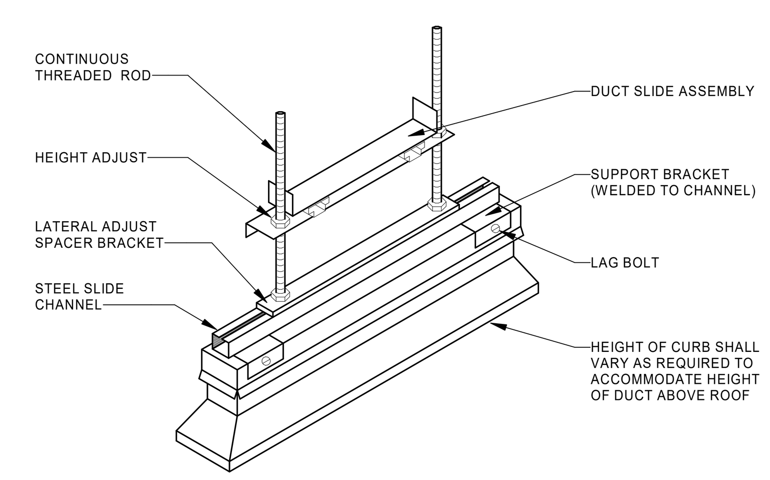
DUCT RECTANGULAR SHEETMETAL ELBOWS
NO SCALE



GAS CONNECTION DETAIL - ROOFTOP UNIT
NO SCALE



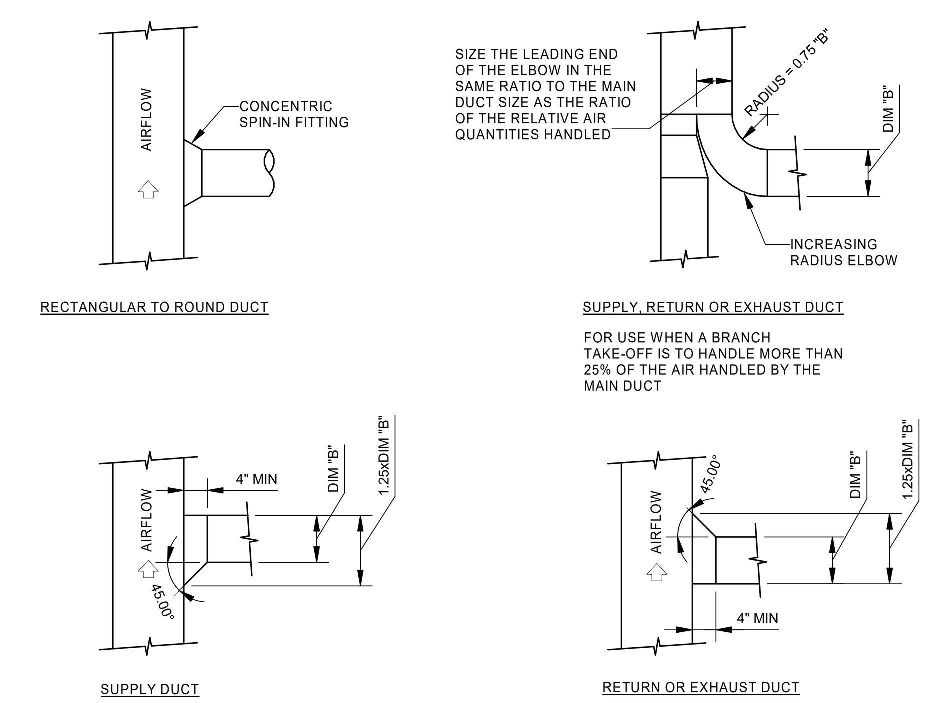
GAS GENERATOR PIPING DETAIL
NO SCALE



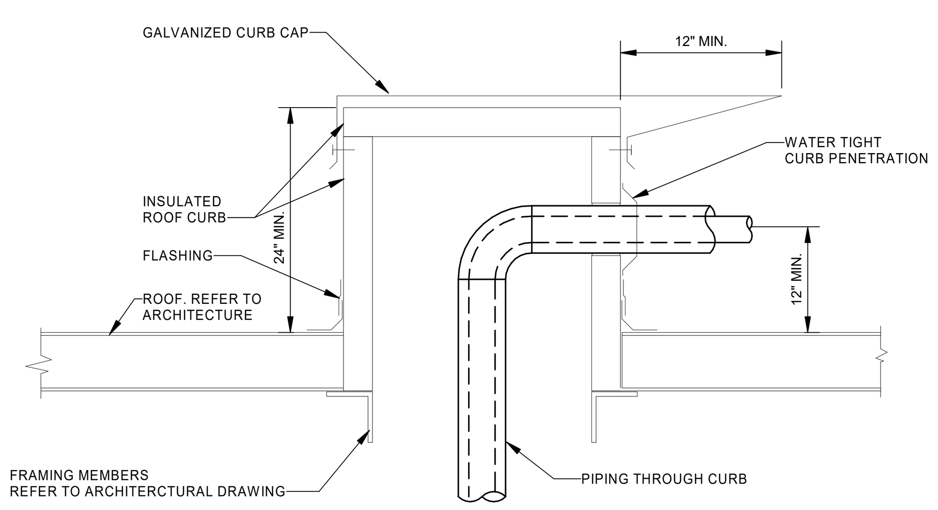
NOTE:

DUCT MOUNTING PEDESTAL SHALL BE AS MANUFACTURED BY RPS CORPORATION

DUCT SUPPORT- MOUNTING PEDESTAL (ROOF MOUNTED DUCTWORK)
NO SCALE

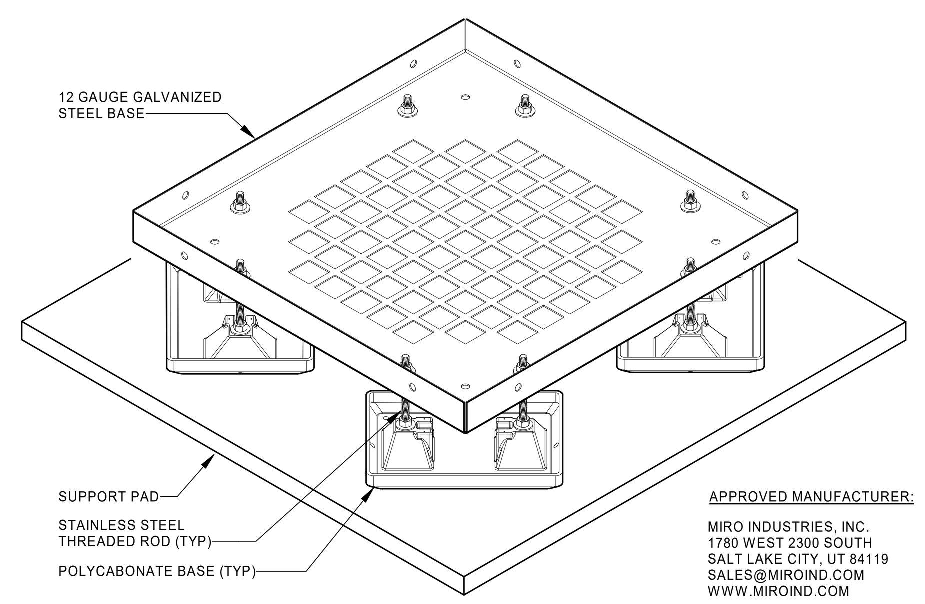


DUCT RECTANGULAR BRANCH TAKE-OFF DETAILS
NO SCALE



NOTE: PROVIDE SIMILAR INSTALLATION FOR VENTED DRYER EXHAUST TERMINATION.

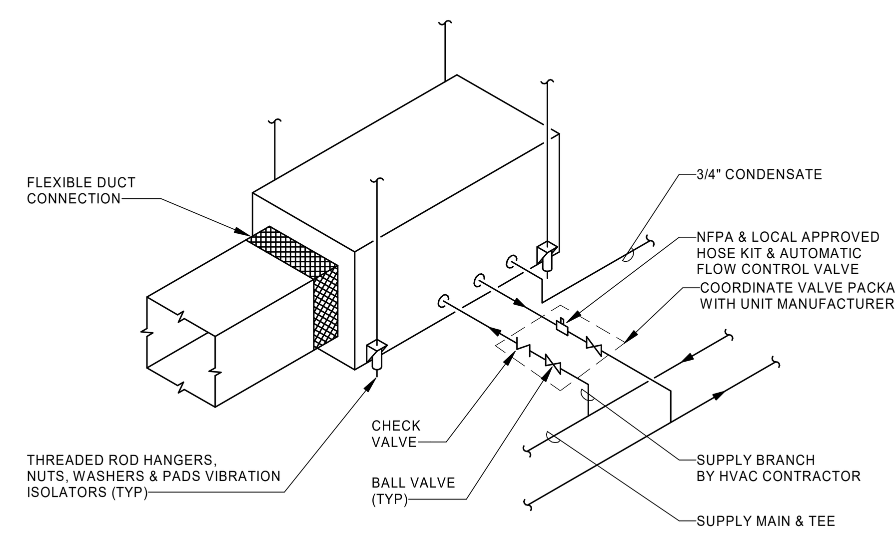
PIPE CURB HORIZONTAL PENETRATION DETAIL
NO SCALE



APPROVED MANUFACTURER:

MIRO INDUSTRIES, INC.
1780 WEST 2300 SOUTH
SALT LAKE CITY, UT 84119
SALES@MIROIND.COM
WWW.MIROIND.COM

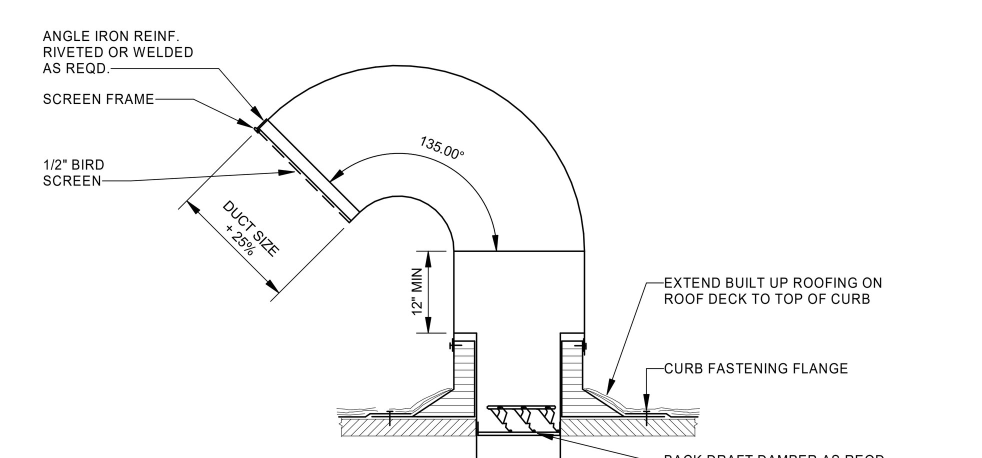
ROOF MOUNTED EQUIPMENT SUPPORT DETAIL #2
NO SCALE



NOTES:

1. PIPING FOR VERTICAL UNITS SIMILAR.
2. COORDINATE ACCESS PANEL HANDINESS/LOCATION AND SA/RA OPENNING WITH DRAWINGS PRIOR TO ORDERING.
3. PROVIDE LINING FOR RETURN DUCTWORK DIRECTLY CONNECTED TO HEAT PUMPS.
4. PROVIDE FLEXIBLE CONNECTION FOR ALL DUCTWORK CONNECTED DIRECTLY TO HEAT PUMP (SUPPLY AND RETURN).

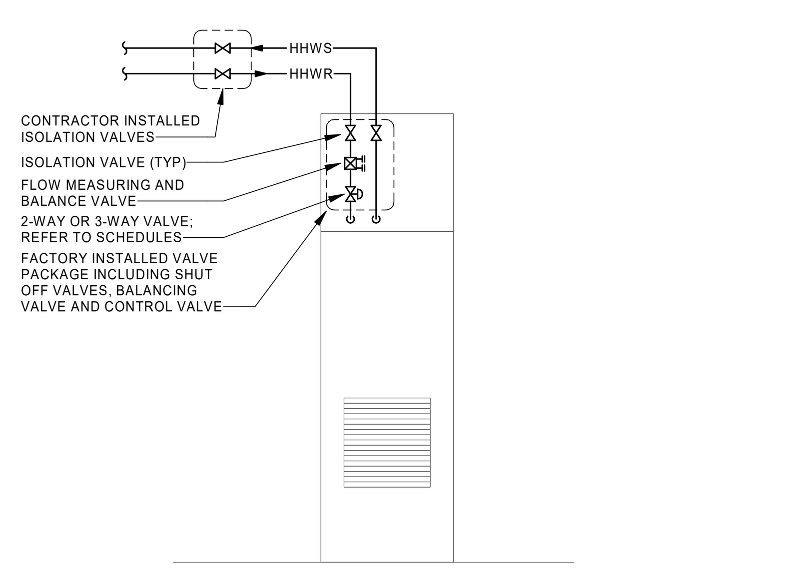
HEAT PUMP HORIZONTAL INSTALLATION DETAIL
NO SCALE



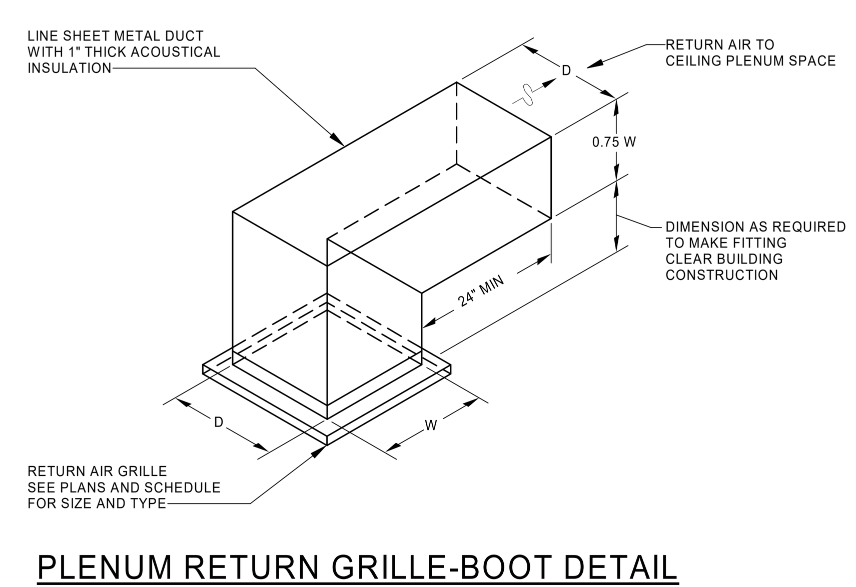
NOTES:

1. WATERPROOF ALL SEAMS AND JOINTS

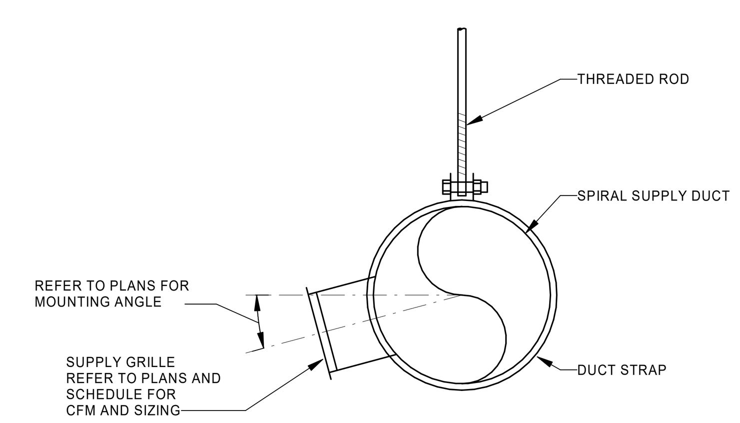
DUCT GOOSENECK DETAIL
NO SCALE



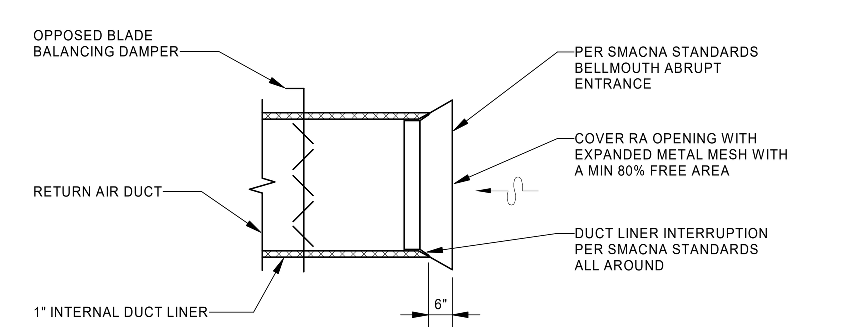
UNIT VENTILATOR - VERTICAL- PIPING DETAIL
NO SCALE



PLENUM RETURN GRILLE-BOOT DETAIL
NO SCALE



DIFFUSER- SPIRAL DUCT MOUNTED
NO SCALE



PLENUM RETURN BELLMOUTH W DAMPER
NO SCALE

PLEASE RECYCLE

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
MECHANICAL DETAILS

SHEET NO.
M5.0

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PLEASE RECYCLE

ROOFTOP AIR HANDLING UNIT SCHEDULE - (GEOTHERMAL)

UNIT ID	TOTAL SUPPLY (CFM)	MINIMUM OA (CFM)	SUPPLY FAN ESP (IN WG)	SUPPLY FAN FAN TYPE	SUPPLY FAN DRIVE TYPE	SUPPLY FAN BHP	SUPPLY FAN HP	EXHAUST FAN ESP (IN WG)	EXHAUST FAN FAN TYPE	EXHAUST FAN DRIVE TYPE	EXHAUST FAN BHP	EXHAUST FAN HP	ERV UNIT ID
RTU-136	8100	2620	1.20	BACKWARD CURVED	DIRECT	7.02	10	0.25	BACKWARD CURVED	DIRECT	6.01	10	ERV-RTU-136
RTU-156	11800	3850	1.25	BACKWARD CURVED	DIRECT	8.19	15	0.25	BACKWARD CURVED	DIRECT	0.66	1	ERV-RTU-156
RTU-DOAS-100	7100	7100	1.00	BACKWARD CURVED PLENUM	DIRECT	6.27	10	0.75	BACKWARD CURVED PLENUM	DIRECT	5.8	7.5	ERV-DOAS-100

UNIT ID	GEOTHERMAL HEAT PUMP COOLING TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	AIR EDB (°F)	AIR EWB (°F)	AIR LDB (°F)	AIR LWB (°F)	AIR APD (IN WG)	23.5% PROPYLENE GLYCOL FLOW (GPM)	EWT (°F)	LWT (°F)	MAX. WPD (FT HD)	CONTROL VALVE CONFIG.
RTU-136	360	300	76.1	64.8	52.2	51.9	0.54	46	90	107.1	10.00	2-WAY
RTU-156	523	434	76.1	64.7	52.4	51.9	0.50	72	90	106	15.00	2-WAY
RTU-DOAS-100	429	302	79.04	68.03	54.14	53.56	0.50	75	90	100.4	20.00	3-WAY

UNIT ID	GEOTHERMAL HEAT PUMP HEATING MIN. TOTAL CAPACITY (MBH)	AIR EAT (°F)	AIR LAT (°F)	AIR APD (IN WG)	23.5% PROPYLENE GLYCOL FLOW (GPM)	EWT (°F)	LWT (°F)	MAX. WPD (FT HD)	CONTROL VALVE CONFIG.	FILTER TYPE
RTU-136	247.7	-0.5	111	0.50	46	32	23.7	10.00	3-WAY	MERV 13
RTU-156	376.3	-0.5	115	0.50	72	32	24.1	15.00	2-WAY	MERV 13
RTU-DOAS-100	520.4	55	88	0.50	75	32	26	20.00	2-WAY	MERV 13

UNIT ID	ELECTRICAL MOCP	MCA	FLA	VOLTS	PHASE	STARTER/DISCONNECT TYPE	FURN. BY	INST. BY	CURB HEIGHT (IN)	UNIT WEIGHT (LBS)	MANUFACTURER / MODEL NO.	REMARKS
RTU-136	90	72	67	460	3	NON-FUSED	MFR	MFR	14"	4300	AAON / RNA-025	
RTU-156	110	90	84	460	3	NON-FUSED	MFR	MFR	40"	7215	AAON / RNA-040	
RTU-DOAS-100	150	145	140	460	3	NON-FUSED	MFR	MFR	14"	3800	AAON / RN-025	

NOTES:
1. DUCT SMOKE DETECTORS ON UNIT SUPPLY AND RETURN FOR AIRFLOW OVER 1900 CFM. DETECTORS SHALL BE BY DIVISION 28. TCC SHALL WIRE FROM DETECTOR TO UNIT SHUTOFF.
2. UNIT TO BE PROVIDED WITH MANUFACTURER CONTROLS. REFER TO CONTROLS DIAGRAM AND SOO. CONTROLLER SHALL BE CAPABLE OF FULLY INTEGRATING INTO THE BMS.
3. ALL FANS SELECTED FOR RTUS MUST MEET REQUIREMENTS OF ASHRAE STANDARD 90.1-2013, SECTION 6.5.3.1.2. WHEN INDUCTION MOTORS ARE USED THEN THE REQUIREMENT IS TO USE THE NEXT AVAILABLE NEMA NAMEPLATE HORSEPOWER MOTOR, AND WHEN ECM'S ARE USED THE REQUIREMENT IS TO USE THE NEXT AVAILABLE ECM NAMEPLATE HORSEPOWER MOTOR. REFER TO INTERPRETATION IC90.1-2013-11 ADDITIONAL INFORMATION.
4. PROVIDE UNIT WITH FACTORY WIRED 115V GFCI CONVENIENCE OUTLET.
5. PROVIDE SINGLE POINT POWER, FACTORY WIRED.
6. MAINTAIN UNIT SERVICE CLEARANCES ON FRONT, BACK, SIDE, AND TOP OF UNIT. ENSURE OUTDOOR AIR INTAKE IS GREATER THAN 10'-0" FROM ANY BUILDING EXHAUST.
7. COORDINATE FIELD INSTALLATION OF ALL EQUIPMENT SHIPPED LOOSE FROM MANUFACTURER.
8. ANY ITEM IN CONTRACT DOCUMENTS NOT INCLUDED BY MANUFACTURER SHALL BE PROVIDED BY DIVISION 23. VERIFY WITH FINAL APPROVED EQUIPMENT SUBMITTAL.
9. PROVIDE RTU-136 WITH HORIZONTAL SUPPLY AND RETURN CONNECTIONS. PROVIDE RTU-156 WITH DOWN DISCHARGE AND THYBAR ROOF CURB FOR HORIZONTAL SUPPLY AND RETURN. PROVIDE RTU-DOAS-100 WITH DOWN SUPPLY AND RETURN.
10. PROVIDE WITH HOT GAS REHEAT
    A. RTU-136: 188.5 MBH
    B. RTU-156: 275 MBH
    C. RTU-DOAS-100: 145 MBH
11. PROVIDE WITH ELECTRIC PREHEAT COIL.
    A. RTU-136: 40 KW; SEPARATE DISCONNECT REQUIRED - 460V / 3 PHASE, 50.2 FLA
    B. RTU-156: 50 KW; SEPARATE DISCONNECT REQUIRED - 460V / 3 PHASE, 62.8 FLA
    C. RTU-DOAS-100: 50 KW; ELECTRICAL PERFORMANCE AND REQUIREMENTS ARE PART OF UNIT. ONE DISCONNECT FOR ENTIRE UNIT.
12. R-410A VARIABLE CAPACITY SCROLL
13. PROVIDE WITH DRY-BULB ECONOMIZER
14. PROVIDE WITH BALANCING VALVES, WATER FLOW SWITCH, AND HEAD PRESSURE CONTROL
15. MINIMUM OPERATING CONDITIONS EFFICIENCY:
    A. RTU-136
       a. EER: 10.4
       b. COP: 4.8
    B. RTU-156
       a. EER: 12.3
       b. COP: 4.89
    C. RTU-DOAS-100
       a. EER: 13.8
       b. COP: 5.98
16. COORDINATE UNITS AIC RATINGS WITH ELECTRICAL CONTRACTOR.

ENERGY RECOVERY SECTION SCHEDULE

UNIT ID	RTU OR AHU UNIT ID	SUMMER OUTSIDE AIR EDB (°F)	SUMMER OUTSIDE AIR EWB (°F)	SUMMER OUTSIDE AIR LDB (°F)	SUMMER OUTSIDE AIR LWB (°F)	SUMMER EXHAUST AIR EDB (°F)	SUMMER EXHAUST AIR RH	SUMMER EXHAUST AIR LDB (°F)	SUMMER EXHAUST AIR LWB (°F)	WINTER OUTSIDE AIR EDB (°F)	WINTER OUTSIDE AIR LDB (°F)	WINTER EXHAUST AIR EDB (°F)	WINTER EXHAUST AIR RH	WINTER EXHAUST AIR LDB (°F)	REMARKS
ERV-136	RTU-136	89	73.2	78.5	66.5	75	55	85	71	-0.5	51.3	70	20	17.1	
ERV-156	RTU-156	89	73.2	78.3	66.1	75	55	85.4	71	-0.5	52.1	70	20	16.9	
ERV-DOAS-100	RTU-DOAS-100	89	73.2	79.04	68.03	75	55	85.09	69.53	21	55	70	20	35	

NOTES:
1. ERV TO BE PACKAGED WITH RTU EQUIPMENT.

ELECTRIC TEMPERING COIL SCHEDULE

UNIT ID	SERVICE	CAPACITY (kW)	STAGES	AIR MIN FLOW (CFM)	AIR MAX LDB (°F)	AIR MIN AIR VELOCITY (FT/MIN)	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
ETC-HP-108	HP-108	3.0	1	400	95	400	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM4	
ETC-HP-114	HP-114	3.0	1	250	95	560	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECS4	
ETC-HP-139	HP-139	3.0	1	400	95	400	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM4	
ETC-HP-140	HP-140	3.0	1	400	95	400	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM4	
ETC-HP-141	HP-141	3.0	1	400	95	400	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM4	
ETC-HP-145	HP-145	3.0	1	400	95	400	208	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM4	
ETC-HP-201	HP-201	7.3	2	550	95	550	460	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM84	
ETC-HP-301	HP-301	7.3	2	550	95	550	460	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM84	
ETC-HP-401	HP-401	11	2	700	95	700	460	3	MFR	MFR	SWITCH	WATERFURNACE/THERMOLEC / ECM124	

NOTES:
1. HEATER TO BE PROVIDED BY SAME MANUFACTURER/PRODUCT REPRESENTATIVE AS WATER SOURCE HEAT PUMP.
2. HEATER TO BE CONTROLLED BY WATER SOURCE HEAT PUMP CONTROLLER.
3. PROVIDE WITH FACTORY MOUNTED DISCONNECT (SEPARATE FROM HEAT PUMP DISCONNECT).
4. FIELD VERIFY DUCT SIZE REQUIREMENTS WITH SHEET METAL CONTRACTOR.

WATER SOURCE HEAT PUMP SCHEDULE - (GEOTHERMAL)

UNIT ID	SERVICE	TOTAL AIRFLOW (CFM)	OA AIRFLOW (CFM)	ESP (IN-WG)	SUPPLY FLUID (23% PG) FLOW (GPM)	SUPPLY FLUID WPD (FT HD)	COOLING TOTAL CAPACITY (MBH)	COOLING SENSIBLE CAPACITY (MBH)	COOLING EWT (°F)	COOLING LWT (°F)	COOLING EDB (°F)	COOLING EWB (°F)	COOLING LDB (°F)	HEATING TOTAL CAPACITY (MBH)	HEATING EWT (°F)	HEATING LWT (°F)	HEATING EAT (°F)	HEATING LAT (°F)
HP-A-114	UNIT 100	465	0	0.40	2.0	10.60	8.7	7.1	90	100	75	63	60.9	7.0	32	26	70	84
HP-A-117	UNIT 100	465	0	0.40	2.0	10.60	8.7	7.1	90	100	75	63	60.9	7.0	32	26	70	84
HP-A-126	UNIT 100	465	0	0.40	2.0	10.60	8.7	7.1	90	100	75	63	60.9	7.0	32	26	70	84
HP-B-103	UNIT 100	465	0	0.40	3.0	4.10	12.32	9.22	90	100	75	63	56.6	8.53	32	26	70	87
HP-B-104	UNIT 100	465	0	0.40	3.0	4.10	12.32	9.22	90	100	75	63	56.6	8.53	32	26	70	87
HP-C-140	UNIT 100	850	0	0.40	3.5	6.40	13.75	11.79	90	100	75	63	62.2	11.04	32	26	70	82
HP-E-108	UNIT 100	955	0	0.40	6.0	12.60	22.49	22.22	90	100	75	63	56.9	18.02	32	26	70	87.5
HP-E-116	UNIT 100	955	0	0.40	6.0	12.60	22.49	22.22	90	100	75	63	56.9	18.02	32	26	70	87.5
HP-E-155	UNIT 100	955	0	0.40	6.0	12.60	22.49	22.22	90	100	75	63	56.9	18.02	32	26	70	87.5
HP-F-151	UNIT 100	900	0	0.40	6.0	8.40	25.02	18.46	90	100	75	63	56	17.93	32	26	70	88.5
HP-F-201	UNIT 200	900	150	0.40	6.0	8.40	25.61	20.28	90	100	77.3	64.3	58.7	18.46	32	27	58	74.9
HP-G-301	UNIT 300	1300	160	0.40	8.0	11.50	25.73	21.83	90	98	76.7	63.8	59.4	19.9	32	28	61	76.8
HP-I-135	UNIT 100 SERVERY	1300	0	0.40	9.0	10.40	35.24	27.42	90	100	75	63	55.5	25.79	32	26	70	88.4
HP-I-139	UNIT 100	1300	0	0.40	9.0	10.40	35.24	27.42	90	100	75	63	55.5	25.79	32	26	70	88.4
HP-I-141	UNIT 100	1300	0	0.40	9.0	10.40	35.24	27.42	90	100	75	63	55.5	25.79	32	26	70	88.4
HP-I-145	UNIT 100	1300	0	0.40	9.0	10.40	35.24	27.42	90	100	75	63	55.5	25.79	32	26	70	88.4
HP-I-147	UNIT 100	1300	0	0.40	9.0	10.40	35.24	27.42	90	100	75	63	55.5	25.79	32	26	70	88.4
HP-I-401	UNIT 400	1300	235	0.40	9.0	10.40	35.87	29.08	90	100	77.5	64.4	57.6	26.44	32	27	57	75.1
HP-K-132	UNIT 100 KITCHEN	1550	0	0.40	12.0	11.70	45.22	30.61	90	100	75	63	56.7	34.47	32	26	70	90.6

UNIT ID	ELECTRICAL MOCP	MCA	FLA	VOLTS	PHASE	DISCONNECT FURN. BY	INST. BY	TYPE	MANUFACTURER / MODEL NO.	REMARKS
HP-A-114	10.15	6.1	5.0	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 009	2KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 5, 6-16
HP-A-117	10.15	6.1	5.0	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 009	NOTES 1, 5, 6-16
HP-A-126	10.15	6.1	5.0	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 009	NOTES 1, 5, 6-16
HP-B-103	10.15	7.1	5.8	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 012	NOTES 1, 5, 6-16
HP-B-104	10.15	7.1	5.8	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 012	NOTES 1, 5, 6-16
HP-C-140	15	11.9	10.3	208	1	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 015	1 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-E-108	10.15	6.5	5.5	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 024	1 KW ELECTRIC HEAT; NOTES 1, 3, 4, 6-16
HP-E-116	10.15	6.5	5.5	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 024	NOTES 1, 3, 4, 6-16
HP-E-155	10.15	6.5	5.5	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 024	NOTES 1, 3, 4, 6-16
HP-F-151	10.15	8.4	7.6	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 026	NOTES 1, 2-4, 6-16
HP-F-201	10.15	8.4	7.6	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 026	6 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 2-4, 6-16
HP-G-301	10.15	6.6	5.7	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 030	7 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-I-135	15	11.2	9.8	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 038	NOTES 1, 2-4, 6-16
HP-I-139	15	11.2	9.8	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 038	3 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-I-141	15	11.2	9.8	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 038	1 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-I-145	15	11.2	9.8	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 038	3 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-I-147	15	11.2	9.8	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 038	NOTES 1, 3, 4, 6-16
HP-I-401	10.15	6.6	5.7	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 030	8 KW ELECTRIC HEAT (SEE SCHEDULE); NOTES 1, 3, 4, 6-16
HP-K-132	15	12.10	10.50	460	3	MFR	MFR	NON-FUSED	WATERFURNACE 500 SERIES / 049	(SEE SCHEDULE); NOTES 1, 3, 4, 6-16

NOTES:
1. SINGLE SPEED COMPRESSOR
2. TWO SPEED COMPRESSOR
3. HOT GAS REHEAT
4. VARIABLE SPEED ECM BLOWER
5. VARIABLE SPEED CONSTANT TORQUE ECM BLOWER
6. INSULATED COPPER WATER COIL
7. SOUND KIT
8. COMPOSITE DRAIN PAN WITH NO SECONDARY CONNECTION
9. ALL ALUMINUM, UNCOATED AIR COIL
10. MERV 13 FILTER WITH 4-SIDED FILTER RACK
11. AURORA DDC CONTROLLER TO BE INTERFACED AND COMPATABLE WITH BACNET BMS
12. 2-WAY WATER VALVE W/ WATER FLOW REGULATOR
13. HOSE KIT WITH MEMORY STOP.
14. ROOM THERMOSTAT (REFER TO DRAWING FOR LOCATION) WITH TEMPERATURE (AND HUMIDITY WHERE HOT GAS REHEAT AVAILABLE), WITH SLIDER AND NO DIGITAL DISPLAY.
15. BI-POLAR IONIZATION
16. PROVIDE LINING FOR RETURN DUCTWORK DIRECTLY CONNECTED TO HEAT PUMPS. PROVIDE FLEXIBLE CONNECTION FOR ALL DUCTWORK CONNECTED DIRECTLY TO HEAT PUMP (SUPPLY AND RETURN).
17. PROVIDE HP-I-141 AND HP-1-145 WITH 3-WAY CONTROL VALVE.

UNIT VENTILATOR SCHEDULE - (GEOTHERMAL)

UNIT ID	AIRFLOW (CFM)	MIN. OA (CFM)	HEATING COIL MIN. TOTAL CAPACITY (MBH)	HEATING AIR EAT (°F)	HEATING AIR LAT (°F)	HEATING GLYCOL FLOW (GPM)	HEATING GLYCOL EWT (°F)	HEATING GLYCOL LWT (°F)	HEATING GLYCOL MAX. WPD (FT HD)	COOLING COIL TOTAL CAPACITY (MBH)	COOLING SENSIBLE CAPACITY (MBH)	COOLING AIR EDB (°F)	COOLING AIR EWB (°F)	COOLING AIR LDB (°F)	COOLING AIR LWB (°F)	COOLING GLYCOL FLOW (GPM)	COOLING GLYCOL EWT (°F)	COOLING GLYCOL LWT (°F)	COOLING GLYCOL MAX. WPD (FT HD)	CONTROL VALVE CONFIG.
VUV-A-202	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	2-WAY
VUV-A-205	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	2-WAY
VUV-A-208	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	3-WAY
VUV-A-211	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	3-WAY
VUV-A-214	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	2-WAY
VUV-A-217	1500	500	34.6	61.8	83.2	12	32	27.5	13.50	46.5	34	77	65	56.1	52.3	12	90	99.5	8.80	2-WAY
VUV-A-303	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-304	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-305	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-306	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-307	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	3-WAY
VUV-A-308	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	3-WAY
VUV-A-411	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	3-WAY
VUV-A-412	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	3-WAY
VUV-A-413	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-414	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-415	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY
VUV-A-416	1500	545	34.7	59.9	81.3	12	32	27.5	13.50	47.3	34	77	65	56.9	53.7	12	90	99.5	8.80	2-WAY

UNIT ID	DEPTH (IN)	WIDTH (IN)	HEIGHT (IN)	MOCP	MCA	FLA	VOLTS	PHASE	FURN. BY	INST. BY	FILTER TYPE	MANUFACTURER / MODEL NO.	REMARKS
VUV-A-202	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-205	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-208	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-211	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-214	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-217	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-303	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-304	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-305	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-306	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-307	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-308	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-411	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-412	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-413	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-414	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-415	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER
VUV-A-416	33"	48"	90"	20	18.7	16.0	460	3	MFR	MFR	MERV 13	AIREDALE / SMG48	PROVIDE WITH 3KW AUXILIARY HEATER

NOTES:
1. COORDINATE UNIT AND PIPING ARRANGEMENT WITH FIELD CONDITIONS PRIOR TO ORDERING.
2. PROVIDE WITH FACTORY MOUNTED AND WIRED UNIT DISCONNECT SWITCH.
3. PROVIDE WITH MODINE CONTROL SYSTEMS AND INTEGRATE INTO BACNET CONTROLS SYSTEM. REFER TO CONTROL DRAWINGS.
4. PROVIDE WITH EC MOTORS.
5. PROVIDE UNIT WITH PIPING PACKAGE INCLUSIVE OF: COMINATION STRAINER W/ BALL VALVE, BLOW DOWN, UNITION & PT PORTS, CONTROL VALVE, AND COMBINATION AUTO-FLOW VALVE WITH SHUT OFF & PT PORTS. ENSURE CONTROL VALVE IS SELECTED CONTROL VALVE SHALL BE SELECTED FOR A PRESSURE DROP EQUAL TO TWO TIMES THE PRESSURE DROP OF THE ASSOCIATED HEAT TRANSFER DEVICE, BUT NOT MORE THAN 10 FT OF HEAD OR LESS THAN 2.3 FT OF HEAD.
6. PROVIDE WITH OA & RA DAMPER & ECONOMIZER WITH POWERED EXHAUST.
7. PROVIDE STUDY PACKAGE CONSTRUCTION.
8. PROVIDE HOT GAS REHEAT.
9. PROVIDE WITH OUTDOOR AIR LOUVER, ADAPTER BACK, END PANELS, AND DUCT SHROUD.
10. PROVIDE COPPER CONDENSATE DRAIN THROUGH EXTERIOR WALL, TERMINATE WITH ELBOW TOWARDS GRADE.
11. PROVIDE LIGHT GRAY COLOR.

MAKE UP AIR UNIT SCHEDULE - (GAS HEATING ONLY)

UNIT ID	SERVICE	AIRFLOW (CFM)	SUPPLY FAN ESP (IN WG)	FAN TYPE	DRIVE TYPE	BHP	HP	NATURAL GAS HEATING INPUT (MBH)	OUTPUT (MBH)	GAS PRESS. MIN.-MAX. (IN WG)	BURNER TYPE	EAT (°F)	LAT (°F)	FILTER TYPE	ELECTRICAL MOCP	MCA	VOLTS	PHASE	DISCONNECT FURN. BY	INST. BY	CURB HEIGHT (IN)	UNIT WEIGHT (LBS)	MANUFACTURER / MODEL NO.	REMARKS
MAU-100	KITCHEN	1760	1.00	MIXED FLOW	DIRECT DRIVE	0.95	1.5	155	142.6	7-14	DIRECT FIRED	-5	70	MERV 8	15	4.1	460	3	MFR	MFR	16	780	GREENHECK / DGX-P109-HA12-MF	

NOTES:
1. TEMPERATURE CONTROLS BY TCC AND COORDINATED WITH KITCHEN HOOD CONTROLLER. REFER TO CONTROLS DIAGRAM AND SOO.
2. ALL FANS SELECTED FOR RTUS MUST MEET REQUIREMENTS OF ASHRAE STANDARD 90.1-2013, SECTION 6.5.3.1.2. WHEN INDUCTION MOTORS ARE USED THEN THE REQUIREMENT IS TO USE THE NEXT AVAILABLE NEMA NAMEPLATE HORSEPOWER MOTOR, AND WHEN ECM'S ARE USED THE REQUIREMENT IS TO USE THE NEXT AVAILABLE ECM NAMEPLATE HORSEPOWER MOTOR. REFER TO INTERPRETATION IC90.1-2013-11 ADDITIONAL INFORMATION.
3. PROVIDE SINGLE POINT POWER, FACTORY WIRED. MANUFACTURER TO PROVIDE DISCONNECT.
4. MAINTAIN UNIT SERVICE CLEARANCES ON FRONT, BACK, SIDE, AND TOP OF UNIT. ENSURE OUTDOOR AIR INTAKE IS GREATER THAN 10'-0" FROM ANY BUILDING EXHAUST.
5. COORDINATE FIELD INSTALLATION OF ALL EQUIPMENT SHIPPED LOOSE FROM MANUFACTURER.
6. ANY ITEM IN CONTRACT DOCUMENTS NOT INCLUDED BY MANUFACTURER SHALL BE PROVIDED BY DIVISION 23. VERIFY WITH FINAL APPROVED EQUIPMENT SUBMITTAL.

PUMP SCHEDULE

UNIT ID	SYSTEM SERVED	TYPE	FLOW (GPM)	HEAD (FT)	MIN % EFF	ELECTRICAL BHP	HP	VOLTS	PHASE	DISCONNECT FURN. BY	INST. BY	TYPE	STARTER TYPE	SIZE	FURN. BY	INST. BY	MANUFACTURER / MODEL NO.	REMARKS
GHXP-101	UNIT 100 GEOTHERMAL PRIMARY LOOP	END SUCTION BASE MOUNTED	285	71	71	7.1	10	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-1510 2.5BB	
GHXP-102	UNIT 100 GEOTHERMAL PRIMARY LOOP	END SUCTION BASE MOUNTED	285	71	71	7.1	10	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-1510 2.5BB	
GHXP-103	UNIT 100 GEOTHERMAL SECONDARY LOOP	END SUCTION BASE MOUNTED	290	90	76.5	9	15	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-1510 2.5AC	
GHXP-104	UNIT 100 GEOTHERMAL SECONDARY LOOP	END SUCTION BASE MOUNTED	290	90	76.5	9	15	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-1510 2.5AC	
GHXP-201	UNIT 200 GEOTHERMAL PRIMARY LOOP	INLINE	90	78	52	2.38	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-202	UNIT 200 GEOTHERMAL PRIMARY LOOP	INLINE	90	78	25	2.38	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-203	UNIT 200 GEOTHERMAL SECONDARY LOOP	INLINE	76	63	50.4	2.4	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-204	UNIT 200 GEOTHERMAL SECONDARY LOOP	INLINE	76	63	50.4	2.4	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-301	UNIT 300 GEOTHERMAL PRIMARY LOOP	INLINE	85	40	60.7	1.44	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-60	
GHXP-302	UNIT 300 GEOTHERMAL PRIMARY LOOP	INLINE	85	40	60.7	1.44	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-60	
GHXP-303	UNIT 300 GEOTHERMAL SECONDARY LOOP	INLINE	85	63	53.7	2.55	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-304	UNIT 300 GEOTHERMAL SECONDARY LOOP	INLINE	85	63	53.7	2.55	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-401	UNIT 400 GEOTHERMAL PRIMARY LOOP	INLINE	85	40	60.7	1.44	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-60	
GHXP-402	UNIT 400 GEOTHERMAL PRIMARY LOOP	INLINE	85	40	60.7	1.44	3	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-60	
GHXP-403	UNIT 400 GEOTHERMAL SECONDARY LOOP	INLINE	85	63	53.7	2.55	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	
GHXP-404	UNIT 400 GEOTHERMAL SECONDARY LOOP	INLINE	85	63	53.7	2.55	5	460	3	MFR	MC	VFD	VFD	-	MFR	MC	BELL & GOSSETT / E-80	

NOTES:
1. PERFORMANCE IS BASED ON 23% PROPYLENE GLYCOL UNLESS NOTED OTHERWISE.
2. PUMPS SHALL BE NON-OVERLOADING.
3. WHEN VFD CONTROL IS SPECIFIED, PROVIDE WITH NEMA PREMIUM EFFICIENT MOTOR WITH AEGIS SHAFT GROUNDING RINGS.
4. BASE MOUNTED PUMPS TO BE MOUNTED ON 4" HOUSEKEEPING PAD.

EXPANSION TANK SCHEDULE

UNIT ID	SYSTEM SERVED	TYPE	MIN PSIG	MAX PSIG	MIN (°F)	MAX (°F)	SYSTEM VOLUME (GAL)	TANK VOLUME (GAL)	DIA (IN)	HEIGHT (IN)	MANUFACTURER / MODEL NO.	REMARKS
ET-100	UNIT 100 HEAT PUMP LOOP	DIAPHRAGM	10.00	50.00	32	90	4500	115	24"	66"	BELL & GOSSETT / D200	
ET-200	UNIT 200 HEAT PUMP LOOP	DIAPHRAGM	10.00	50.00	32	90	1225	60	20"	49"	BELL & GOSSETT / D100	
ET-300	UNIT 300 HEAT PUMP LOOP	DIAPHRAGM	10.00	50.00	32	90	1225	60	20"	49"	BELL & GOSSETT / D100	
ET-400	UNIT 400 HEAT PUMP LOOP	DIAPHRAGM	10.00	50.00	32	90	1250	60	20"	49"	BELL & GOSSETT / D100	

NOTES:
1. PERFORMANCE IS BASED ON 23.5% PROPYLENE GLYCOL UNLESS NOTED OTHERWISE.
2. MOUNT ON 4" HOUSEKEEPING PAD.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 01	03.01.2024
Addendum 03	03.15.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
MECHANICAL SCHEDULES

SHEET NO.
M6.0

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PLEASE RECYCLE

GRILLE, REGISTER AND DIFFUSER SCHEDULE

UNIT ID	TYPE	AIRFLOW (CFM) MIN FLOW	AIRFLOW (CFM) MAX FLOW	FACE SIZE (IN)	NECK SIZE (IN)	LINEAR DIFFUSER DATA SLOT QUANTITY	LINEAR DIFFUSER DATA SLOT WIDTH (IN)	LINEAR DIFFUSER DATA SLOT LENGTH (IN)	MAX AIR PD (IN-WG)	MAX NC	THROW PATTERN	THROW (FT) [50 FPM - 100 FPM - 150 FPM]	MOUNTING	BORDER	MATERIAL	FINISH	ACCESSORY	MANUFACTURER / MODEL NO.	REMARKS
E1-A	PERFORATED FACE	0	100	24x24	6ø	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E1-B	PERFORATED FACE	0	175	24x24	8ø	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E1-C	PERFORATED FACE	0	275	24x24	10ø	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E1-D	PERFORATED FACE	0	100	12x12	6ø	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E1-E	PERFORATED FACE	0	520	24x24	14ø	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E2-A	PERFORATED FACE	0	375	24x12	18x6	-	-	-	0.05	20	-	-	LAY IN CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
E3-A	LOUVERED GRILLE	0	130	NECK+1 3/4	6x6	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE		PRICE / 530/L	-
E3-B	LOUVERED GRILLE	0	600	NECK+1 3/4	18x12	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE		PRICE / 530/L	-
E3-C	LOUVERED GRILLE	0	1000	NECK+1 3/4	24x16	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE		PRICE / 530/L	-
E3-D	LOUVERED GRILLE	0	150	NECK+1 3/4	10x6	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE		PRICE / 530/L	-
R1-A	PERFORATED FACE	0	1125	24x24	18x18	-	-	-	0.05	25	-	-	T-BAR CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
R1-B	PERFORATED FACE	0	1685	24x24	22x22	-	-	-	0.05	25	-	-	T-BAR CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
R1-C	PERFORATED FACE	0	375	24x12	18x6	-	-	-	0.05	25	-	-	T-BAR CEILING	TYPE 3	STEEL	WHITE	-	PRICE / PDDR	-
R3-A	LOUVERED GRILLE	0	9000	NECK+1 3/4	60x40	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE	-	PRICE / 530/L	-
R3-B	LOUVERED GRILLE	0	1500	NECK+1 3/4	36x20	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE	-	PRICE / 530/L	-
R3-C	LOUVERED GRILLE	0	2500	NECK+1 3/4	42x20	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE	-	PRICE / 530/L	-
R3-D	LOUVERED GRILLE	0	1500	NECK+1 3/4	32x18	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE	-	PRICE / 530/L	-
R3-E	LOUVERED GRILLE	0	500	NECK+1 3/4	18x16	-	-	-	0.10	20	45° DEFLECTION	-	SIDEWALL	F	STEEL	WHITE	-	PRICE / 530/L	-
S1-A	SQUARE PLAQUE	0	140	12x12	6ø	-	-	-	0.10	20	4-WAY	3-5-9	LAY IN CEILING	TYPE 31	STEEL	WHITE	-	PRICE / SPD	-
S1-B	SQUARE PLAQUE	0	175	24x24	6ø	-	-	-	0.10	20	4-WAY	3-4-7	LAY IN CEILING	TYPE 31	STEEL	WHITE	-	PRICE / SPD	-
S1-C	SQUARE PLAQUE	180	280	24x24	8ø	-	-	-	0.10	20	4-WAY	3-5-9	LAY IN CEILING	TYPE 31	STEEL	WHITE	-	PRICE / SPD	-
S1-D	SQUARE PLAQUE	285	435	24x24	10ø	-	-	-	0.10	25	4-WAY	4-6-11	LAY IN CEILING	TYPE 31	STEEL	WHITE	-	PRICE / SPD	-
S2-A	LINEAR SLOT	0	160	60x4	6ø	1	1	60	0.15	30	ADJUSTABLE	7-12-20	SURFACE	TYPE 8	ALUMINUM	WHITE	INSULATED PLENUM	PRICE / SDS100	-
S3-A	LOUVERED GRILLE	0	1000	NECK+1 3/4	28x10	-	-	-	0.10	20	45° SINGLE DEFLECTION	26-40-60	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-B	LOUVERED GRILLE	0	670	NECK+1 3/4	22x10	-	-	-	0.10	20	45° SINGLE DEFLECTION	19-29-49	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-C	LOUVERED GRILLE	0	670	NECK+1 3/4	20X10	-	-	-	0.10	20	45° SINGLE DEFLECTION	19-29-49	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-D	LOUVERED GRILLE	0	460	NECK+1 3/4	12X10	-	-	-	0.10	20	45° SINGLE DEFLECTION	18-27-40	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-E	LOUVERED GRILLE	0	360	NECK+1 3/4	18x6	-	-	-	0.10	20	45° SINGLE DEFLECTION	16-23-36	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-F	LOUVERED GRILLE	0	200	NECK+1 3/4	16x4	-	-	-	0.10	20	45° SINGLE DEFLECTION	12-18-27	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S3-G	LOUVERED GRILLE	0	150	NECK+1 3/4	10x4	-	-	-	0.10	20	45° SINGLE DEFLECTION	9-14-22	DUCT	-	GALV. STEEL	UNPAINTED	AIR SCOOP	PRICE / SDGE	-
S4-A	LOUVERED GRILLE	0	600	NECK+1 3/4	16x10	-	-	-	0.10	20	45° SINGLE DEFLECTION	20-30-44	SIDEWALL	-	STEEL	WHITE	-	PRICE / 520L	-
S4-B	LOUVERED GRILLE	0	1000	NECK+1 3/4	20x14	-	-	-	0.10	20	45° SINGLE DEFLECTION	27-40-56	SIDEWALL	-	STEEL	WHITE	-	PRICE / 520L	-
S4-C	LOUVERED GRILLE	0	180	NECK+1 3/4	8x6	-	-	-	0.10	20	45° SINGLE DEFLECTION	4-7-13	SIDEWALL	-	STEEL	WHITE	OPPOSED BLADE DAMPER	PRICE / 520L	-

NOTES:
1. REFER TO ARCHITECTURAL CEILING PLAN AND COORDINATE FRAME TYPE ACCORDINGLY.
2. PROVIDE R1-A & R1-B WITH RETURN AIR CANOPY WHERE NOT DUCTED.

EXHAUST FAN SCHEDULE

UNIT ID	SERVING	TYPE	AIRFLOW (CFM)	ESP (IN WG)	FAN (RPM)	MOTOR BHP	MOTOR HP	MOTOR RPM	MOTOR DRIVE TYPE	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	STARTER FURN. BY	STARTER INST. BY	CURB HEIGHT (IN)	MANUFACTURER / MODEL NO.	REMARKS
EF-100	UNIT 100 LOCKERS	ROOF	625	1.00	1686	0.22	1/4	1725	DIRECT	208	1	MFR	MFR	TOGGLE	MFR	MFR	16"	GREENHECK / G-099-VG	
EF-204	204 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-207	207 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-210	210 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-213	213 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-216	216 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-219	219 TOILET	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-220	220 STAFF	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-221	221 JC	CEILING	50	0.25	850	-	13 W	850	DIRECT	115	1	MFR	MFR	TOGGLE	-	-	0"	GREENHECK / SP-A70	
EF-300	UNIT 300	ROOF	450	0.75	1551	0.13	1/4	1725	DIRECT	208	1	MFR	MFR	TOGGLE	MFR	MFR	16"	GREENHECK / G-098-VG	
EF-400	UNIT 400	ROOF	450	0.75	1551	0.13	1/4	1725	DIRECT	208	1	MFR	MFR	TOGGLE	MFR	MFR	16"	GREENHECK / G-098-VG	
KEF-101	KITCHEN HOOD	CENTRIFUGAL UPBLAST	2200	1.00	1594	0.77	1	1725	DIRECT	208	1	MFR	MFR	NEMA 3 TOGGLE	MFR	MFR	16"	GREENHECK / CUE-140-VG	
KEF-102	DISHWASHER HOOD	CENTRIFUGAL UPBLAST	600	0.75	1466	0.14	1/4	1725	DIRECT	208	1	MFR	MFR	NEMA 3 TOGGLE	MFR	MFR	16"	GREENHECK / CUE-099-VG	

NOTES:
1. PROVIDE WITH GRAVITY BACKDRAFT DAMPER ON ALL FANS EXCEPT FOR KITCHEN COOKING/GREASE.
2. PROVIDE "SP" TYPE FANS WITH GRILLE MOUNTED MOTION DETECTOR WITH TIME DELAY. EF-221 SHALL BE INTERLOCKED TO BMS AND OPERATE ON TIME OF DAY SCHEDULE ONLY.
3. WHERE "VG" IS INDICATED IN MODEL NUMBER, PROVIDE WITH EC MOTOR WITH 0-10 VDC INPUT FOR CONNECTION TO BMS AND CONTROL DIAL FOR BALANCING
4. PROVIDE WITH BIRDSCREEN
5. PROVIDE "KEF-101" AND "KEF-102" WITH:
   A. GREASE BOX
   B. RATED FOR HIGH HEAT APPLICATION
   C. FACTORY MOUNTED CLEANOUT PORT
   D. HINGE

MINI-SPLIT INDOOR UNIT SCHEDULE

UNIT ID	UNIT TYPE	ASSOCIATED OUTDOOR UNIT ID	AREA SERVED	SUPPLY (WET COIL) (CFM)	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	DIMENSIONS LENGTH (IN)	DIMENSIONS WIDTH (IN)	DIMENSIONS HEIGHT (IN)	ELECTRICAL FLA	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
AC-100	WALL MOUNTED	ACCU-100	125 MDF	400	9000	9000	35"	8 1/2"	11 3/4"	0.12	208	1	EC	EC	SWITCH	SAMSUNG / RNS09ABC	
AC-101	WALL MOUNTED	ACCU-101	121 ELEC	400	12000	12000	35"	8 1/2"	11 3/4"	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RNS12ABC	
AC-102	WALL MOUNTED	ACCU-102	154 MDF	350	9000	9000	35"	8 1/2"	11 3/4"	0.12	208	1	EC	EC	SWITCH	SAMSUNG / AR09CSDABWKNCV	
AC-200	WALL MOUNTED	ACCU-200	222 MECH	400	12000	12000	35"	8 1/2"	11 3/4"	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RNS12ABC	
AC-300	WALL MOUNTED	ACCU-300	311 MECH	400	12000	12000	35"	8 1/2"	11 3/4"	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RNS12ABC	
AC-400	WALL MOUNTED	ACCU-400	405 MECH	400	12000	12000	35"	8 1/2"	11 3/4"	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RNS12ABC	

NOTES:
1. HEATING CAPACITY: 11,000 BTUH
2. R410A REFRIGERANT
3. MECHANICAL CONTRACTOR TO PROVIDE WITH UNIT POWERED CONDENSATE PUMP. COORDINATE WITH ELECTRICAL CONTRACTOR.
4. PROVIDE WITH WIRED WALL MOUNT THERMOSTAT.
5. INDOOR UNITS RECIEVE POWER FROM OUTDOOR UNITS THROUGH FIELD SUPPLIED INTERCONNECTED WIRING BY ELECTRICAL CONTRACTOR.
6. PROVIDE INTERCONNECTING CONTROL WIRING AND RUN IN CONDUIT.
7. PROVIDE WITH CONTROL INTERFACE MODULE TO ENSURE UNIT IS INTEGRATED INTO BUILDING BMS.

MINI-SPLIT OUTDOOR UNIT SCHEDULE

UNIT ID	ASSOCIATED INDOOR UNIT ID	COOLING NOMINAL TONNAGE	COOLING MINIMUM SEER	COOLING DESIGN AMBIENT (°F)	COOLING NO. OF FANS	HEATING CAPACITY (MBH)	HEATING DESIGN AMBIENT (°F)	FAN CFM	COMPRESSOR NO.	COMPRESSOR TYPE	ELECTRICAL MOCP	ELECTRICAL MCA	ELECTRICAL FLA	ELECTRICAL VOLTS	ELECTRICAL PHASE	DISCONNECT FURN. BY	DISCONNECT INST. BY	DISCONNECT TYPE	MANUFACTURER / MODEL NO.	REMARKS
ACCU-100	AC-100	0.75	24.5	95	1	11	-22	1600	1	BLDC ROTARY	20	12	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RXS09ACC	
ACCU-101	AC-101	1	23	95	1	12	-4	1600	1	BLDC ROTARY	20	12.5	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RXS12ACC	
ACCU-102	AC-102	0.75	24.5	95	1	11	-4	1600	1	BLDC ROTARY	20	12	0.18	208	1	EC	EC	SWITCH	SAMSUNG / AR09CSDACWKXCV	
ACCU-200	AC-200	1	32	95	1	12	-4	1600	1	BLDC ROTARY	20	12.5	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RXS12ACC	
ACCU-300	AC-300	1	32	95	1	12	-4	1600	1	BLDC ROTARY	20	12.5	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RXS12ACC	
ACCU-400	AC-400	1	32	95	1	12	-4	1600	1	BLDC ROTARY	20	12.5	0.18	208	1	EC	EC	SWITCH	SAMSUNG / RXS12ACC	

NOTES:
1. UNIT TO PROVIDE FULL HEATING CAPACITY DOWN TO -4°F. PROVIDE WIND BAFFLES AND GUARDS ARE REQUIRED FOR LOW AMBIENT OPERATION.
2. UNIT TO PROVIDE HIGH HEATING CAPACITY AT -22°F.
3. PROVIDE WITH CONTROL INTERFACE MODULE TO ENSURE UNIT IS INTEGRATED INTO BUILDING BMS.
4. SINGLE POINT POWER THROUGH OUTDOOR UNIT
5. INSTALL ON 18" ROOFTOP EQUIPMENT SUPPORTS.

ELECTRIC HEATER SCHEDULE

UNIT ID	MBH	kW	CFM	ELECTRICAL VOLTS	ELECTRICAL PHASE	ELECTRICAL AMPS	PHYSICAL SIZE (IN) LENGTH	PHYSICAL SIZE (IN) WIDTH/ DEPTH	PHYSICAL SIZE (IN) HEIGHT	MOUNTING	MANUFACTURER / MODEL NO.	REMARKS
ECUH-B	41	12.00	500	480	3	17.2	48"	10"	26"	CEILING RECESSED	INDEECO / CUI	
ECUH-B	41	12.00	500	480	3	17.2	48"	10"	26"	WALL INVERTED	INDEECO / CUI	
ECUH-D	82	24.00	1000	480	3	34.5	80"	10"	26"	WALL INVERTED	INDEECO / CUI	FULLY RECESSED
EUH-B	34	10.00	650	480	3	12.4	17"	7 3/4"	24 1/4"	SUSPENDED	INDEECO / UHIR	
EUH-C	8.5	2.50	550	208	1	12.3	13"	7 3/4"	17 3/4"	SUSPENDED	INDEECO / UHIR	

NOTES:
ABBREVIATIONS: EBB = ELECTRIC BASEBOARD, ECH = ELECTRIC COVE HEATER, ECUH = ELECTRIC CABINET UNIT HEATER, EUH = ELECTRIC UNIT HEATER, ERCP = ELECTRIC RADIANT CEILING PANEL

1. MANUFACTURER TO PROVIDE BUILT-IN CONTROLS AND FACTORY MOUNTED DISCONNECT. (IF REMOTE THERMOSTAT IS SHOWN ON DRAWINGS, PROVIDE REMOTE THERMOSTAT).

GLYCOL MAKEUP UNIT SCHEDULE

UNIT ID	CAPACITY (GPM@PSI)	VOLUME (GAL)	ELECTRICAL HP	ELECTRICAL VOLTAGE	ELECTRICAL PHASE	MANUFACTURER / MODEL	REMARKS
GMU-100	5 @ 60	55	3/4	115	1	B&G GMU60	
GMU-200	5 @ 60	55	3/4	115	1	B&G GMU60	
GMU-300	5 @ 60	55	3/4	115	1	B&G GMU60	
GMU-400	5 @ 60	55	3/4	115	1	B&G GMU60	

NOTES:
1. THE PACKAGE SHALL CONSIST OF A BASE, POLYETHYLENE RESERVIOR AND REMOVABLE LID, VISIBLE SOLUTION LEVEL SCALE IN GALLONS AND LITERS, Y-STRAINER, ISOLATION VALVE, PUMP, OPEN DRIP-PROOF MOTOR, PUMP ISOLATION, CHECK AND BALANCE VALVE, EXPANSION TANK, DISCHARGE PRESSURE GAUGE, MOTOR CONTACTOR AND CONTROL CIRCUIT IN NEMA 1 PANEL, AND NECESSARY INTERCONNECTING PIPING.
2. HYDRONIC SYSTEM SHALL BE FILLED MANUALLY. REFER TO SPECIFCATIONS. SYSTEM SHALL NOT BE DIRECT CONNECTED TO CITY WATER.
3. MOUNT ON 4" HOUSEKEEPING PAD.

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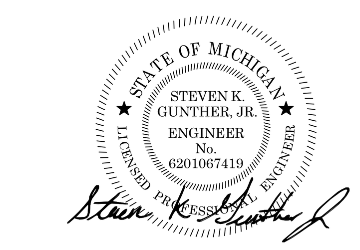
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915



01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
MECHANICAL SCHEDULES

SHEET NO.
M6.1

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UNIT 100 - OA VENTILATION SCHEDULE

ROOM NAME & NUMBER	AREA (FT2)	HEIGHT (FT)	VOLUME (FT3)	GOVERNING CODE		OCCUPANCY CLASSIFICATION	2015 MMC 403.3 & ASHRAE 62.1-2010 TABLE 6-1			VENTILATION								
				MMC	ASHRAE 62.1		PEOPLE RATE (CFM/PP)	AREA RATE (CFM/FT2)	DENSITY #/1000	DEFAULT PEOPLE	ACTUAL PEOPLE	PEOPLE OA (CFM)	AREA OA (CFM)	TOILET #	TOILET EXHAUST (CFM)	TOTAL EA (CFM)	AIR DISTRIBUTION EFFECTIVENESS	TOTAL MIN OA (Voz)
103 CORRIDOR	1162	10	11620	X		CORRIDORS	0	0.06	0	0		0	70			0	0.8	125
104 CORRIDOR	2558	10	25580	X		CORRIDORS	0	0.06	0	0		0	155			0	0.8	230
105 CORRIDOR	294	10	2940	X		CORRIDORS	0	0.06	0	0		0	20			0	0.8	60
106 CORRIDOR	327	10	3270	X		CORRIDORS	0	0.06	0	0		0	20			0	0.8	60
107 CORRIDOR	427	10	4270	X		CORRIDORS	0	0.06	0	0		0	30			0	0.8	75
108 WELCOME	287	10	2870	X		RECEPTION AREA	5	0.06	30	9		45	20			0	0.8	85
109 CORRIDOR	600	10	6000	X		CORRIDORS	0	0.06	0	0		0	40			0	0.8	50
110 CLINIC	150	10	1500	X		OFFICE SPACE	5	0.06	5	1		5	10			0	0.8	50
111 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
112 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
113 SUPPORT	207	10	2070	X		OFFICE SPACE	5	0.06	5	2		10	15			0	0.8	50
114 PRINCIPAL	315	10	3150	X		OFFICE SPACE	5	0.06	5	2		10	20			0	0.8	50
115 SECURITY	138	10	1380	X		OFFICE SPACE	5	0.06	5	1	2	10	10			0	0.8	50
116 CONFERENCE	580	10	5800	X		CONFERENCE ROOM	5	0.06	50	29		145	35			0	0.8	225
117 OFFICE SUPPORT	348	10	3480	X		OFFICE SPACE	5	0.06	4	2		10	25			0	0.8	50
118 OFFICE	157	10	1570	X		OFFICE SPACE	5	0.06	5	1		5	10			0	0.8	50
119 STORAGE	158	16	2528		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
126 MEN	251	10	2510	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0
127 WOMEN	251	10	2510	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0
128 STAFF	86	10	860	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
129STAFF	87	10	870	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
130 JC	136	16	2176	X		JANITOR CLOSET	0	0	0	0		0	0	1	50	136	0.8	0
131 STORAGE	496	16	7936		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
132 KITCHEN	1224	10	12240	X		KITCHEN (COOKING)	0	0	0	0	10	0	0			860	0.8	860
133 DRY STORAGE	418	10	4180		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
135 SERVERY	508	10	5080	X		CAFETERIA/FAST-FOOD DINNING	7.5	0.18	100	51	10	75	95			0	0.8	215
136 CAFETERIA	2956	22	65032	X		CAFETERIA/FAST-FOOD DINNING	7.5	0.18	100	296	207	1555	535			0	0.8	2615
137 STORAGE	266	27	7182		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
138 MUSIC STORAGE	311	16	4976		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
139 MUSIC	1468	16	23488	X		MUSIC/THEATER/DANCE	10	0.06	35	52	31	310	90			0	0.8	500
140 TEACHER'S LOUNGE	492	10	4920		X	BREAKROOMS	5	0.12	50	25		125	60			0	0.8	0
141 ART	1379	15	20685	X		ART CLASSROOMS	10	0.18	20	28		280	250			970	0.8	970
143 ART STORAGE	118	15	1770		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
144 SCIENCE STORAGE	143	16	2288		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
145 CLASSROOM	1391	15	20865	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	49	31	310	170			0	0.8	600
147 RESOURCE	911	10	9110	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	32	31	310	110			0	0.8	525
148 IT STAFF	121	10	1210	X		OFFICE SPACE	5	0.06	5	1		5	10			0	0.8	50
149 IT STAFF	121	10	1210	X		OFFICE SPACE	5	0.06	5	1		5	10			0	0.8	50
150 IT STAFF	130	10	1300	X		OFFICE SPACE	5	0.06	5	1		5	10			0	0.8	50
151 STEAM/COMM.	1164	10	11640	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	41	31	310	140			0	0.8	565
152 SHOWER	95	10	950	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
153 STORAGE	153	16	2448		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
155 FAMILY	804	10	8040	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	29	31	310	100			0	0.8	515

UNIT 200 - OA VENTILATION SCHEDULE

ROOM NAME & NUMBER	AREA (FT2)	HEIGHT (FT)	VOLUME (FT3)	GOVERNING CODE		OCCUPANCY CLASSIFICATION	2015 MMC 403.3 & ASHRAE 62.1-2010 TABLE 6-1			VENTILATION								
				MMC	ASHRAE 62.1		PEOPLE RATE (CFM/PP)	AREA RATE (CFM/FT2)	DENSITY #/1000	DEFAULT PEOPLE	ACTUAL PEOPLE	PEOPLE OA (CFM)	AREA OA (CFM)	TOILET #	TOILET EXHAUST (CFM)	TOTAL EA (CFM)	AIR DISTRIBUTION EFFECTIVENESS	TOTAL MIN OA (Voz)
201 CORRIDOR	1836	10	18360	X		CORRIDORS	0	0.06	0	0		0	115			0	0.8	145
202 CLASSROOM	1012	14	14168	X		CLASSROOM (AGES 5-8)	10	0.12	25	26		260	125			0	0.8	485
203 CUBBIES	232	14	3248		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
204 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
205 CLASSROOM	1009	17.5	17657.5	X		CLASSROOM (AGES 5-8)	10	0.12	25	26		260	125			0	0.8	485
206 CUBBIES	232	16	3712		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
207 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
208 CLASSROOM	1015	14	14210	X		CLASSROOM (AGES 5-8)	10	0.12	25	26		260	125			0	0.8	485
209 CUBBIES	232	14	3248		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
210 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
211 CLASSROOM	1012	17.5	17710	X		CLASSROOM (AGES 5-8)	10	0.12	25	26		260	125			0	0.8	485
212 CUBBIES	232	16	3712		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
213 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
214 CLASSROOM	1206	14	16884	X		CLASSROOM (AGES 5-8)	10	0.12	25	31		310	145			0	0.8	570
215 CUBBIES	232	14	3248		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
216 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
217 CLASSROOM	1210	17.5	21175	X		CLASSROOM (AGES 5-8)	10	0.12	25	31		310	150			0	0.8	575
218 CUBBIES	232	16	3712		X	OCCUPIABLE STORAGE FOR DRY MATERIALS	5	0.06	2	1		5	15			0	0.8	25
219 TOILET	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
220 STAFF	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
221 JC	50	14	700	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
223 STORAGE	268	14	3752		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0

UNIT 300 - OA VENTILATION SCHEDULE

ROOM NAME & NUMBER	AREA (FT2)	HEIGHT (FT)	VOLUME (FT3)	GOVERNING CODE		OCCUPANCY CLASSIFICATION	2015 MMC 403.3 & ASHRAE 62.1-2010 TABLE 6-1			VENTILATION								
				MMC	ASHRAE 62.1		PEOPLE RATE (CFM/PP)	AREA RATE (CFM/FT2)	DENSITY #/1000	DEFAULT PEOPLE	ACTUAL PEOPLE	PEOPLE OA (CFM)	AREA OA (CFM)	TOILET #	TOILET EXHAUST (CFM)	TOTAL EA (CFM)	AIR DISTRIBUTION EFFECTIVENESS	TOTAL MIN OA (Voz)
301 COLLABORATION CORRIDOR	782	10	7820	X		CORRIDORS	0	0.06	0	0		0	50			0	0.8	65
302 CORRIDOR	1205	10	12050	X		CORRIDORS	0	0.06	0	0		0	75			0	0.8	95
303 CLASSROOM	1019	14	14266	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
304 CLASSROOM	1012	17.5	17710	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
305 CLASSROOM	1019	14	14266	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
306 CLASSROOM	1012	17.5	17710	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
307 CLASSROOM	1019	14	14266	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
308 CLASSROOM	1012	17.5	17710	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
309 JC	99	14	1386	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
310 STORAGE	234	14	3276		X	UNOCCUPIABLE STORAGE FOR DRY MATERIALS	0	0	0	0		0	0			0	0.8	0
312 STAFF	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
313 STAFF	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
314 GIRLS	223	10	2230	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0
315 BOYS	224	10	2240	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0

UNIT 400 - OA VENTILATION SCHEDULE

ROOM NAME & NUMBER	AREA (FT2)	HEIGHT (FT)	VOLUME (FT3)	GOVERNING CODE		OCCUPANCY CLASSIFICATION	2015 MMC 403.3 & ASHRAE 62.1-2010 TABLE 6-1			VENTILATION								
				MMC	ASHRAE 62.1		PEOPLE RATE (CFM/PP)	AREA RATE (CFM/FT2)	DENSITY #/1000	DEFAULT PEOPLE	ACTUAL PEOPLE	PEOPLE OA (CFM)	AREA OA (CFM)	TOILET #	TOILET EXHAUST (CFM)	TOTAL EA (CFM)	AIR DISTRIBUTION EFFECTIVENESS	TOTAL MIN OA (Voz)
401 COLLABORATION CORRIDOR	905	10	9050	X		CORRIDORS	0	0.06	0	0		0	55			0	0.8	70
402 OFFICE	216	10	2160	X		OFFICE SPACE	5	0.06	5	2		10	15			0	0.8	35
402 CORRIDOR	1202	10	12020	X		CORRIDORS	0	0.06	0	0		0	75			0	0.8	95
403 PRINCIPAL	216	10	2160	X		OFFICE SPACE	5	0.06	5	2		10	15			0	0.8	35
406 JC	58	14	812	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
407 STAFF	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
408 STAFF	64	10	640	X		TOILET	0	0	0	0		0	0	1	50	50	0.8	0
409 GIRLS	274	10	2740	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0
410 BOYS	274	10	2740	X		TOILET	0	0	0	0		0	0	3	50	150	0.8	0
411 CLASSROOM	1023	14	14322	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
412 CLASSROOM	1016	17.5	17780	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
413 CLASSROOM	1020	14	14280	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
414 CLASSROOM	1013	17.5	17727.5	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
415 CLASSROOM	1020	14	14280	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545
416 CLASSROOM	1013	17.5	17727.5	X		CLASSROOM (AGES 9 PLUS)	10	0.12	35	36	31	310	125			0	0.8	545

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1012 W. Willow
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STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
MECHANICAL SCHEDULES

SHEET NO.
M6.2

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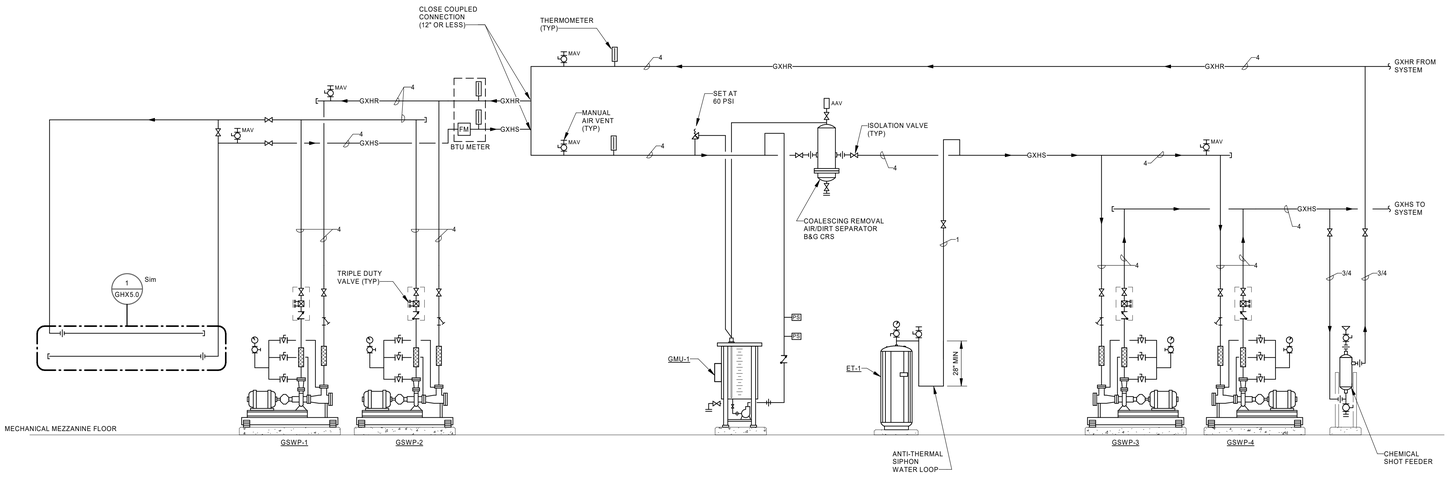
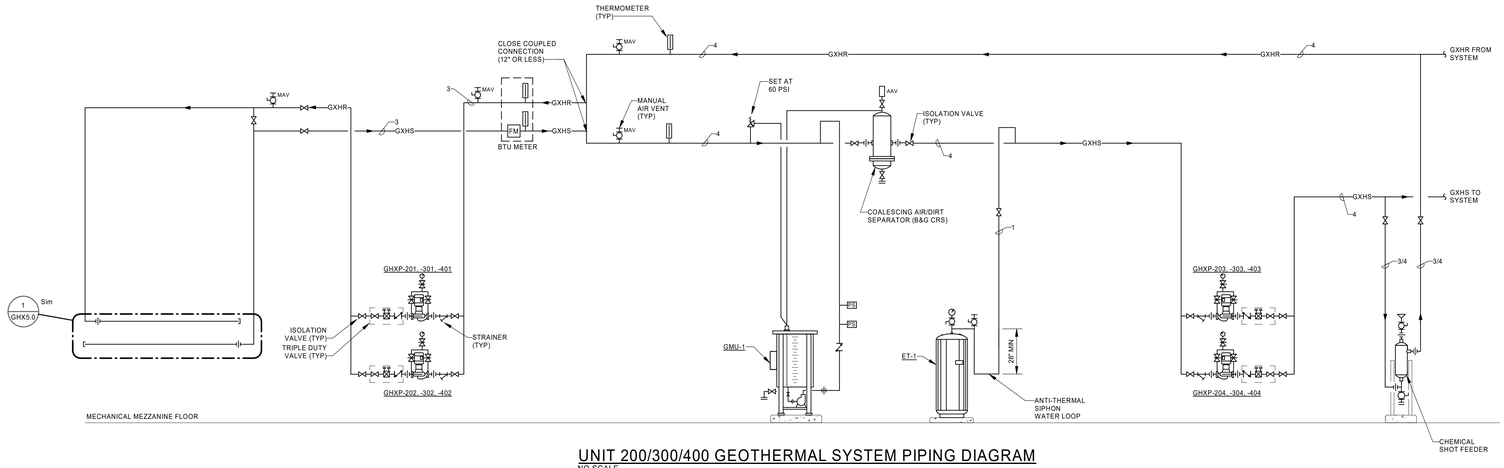


UNIT 100 GEOTHERMAL SYSTEM PIPING DIAGRAM

NO SCALE



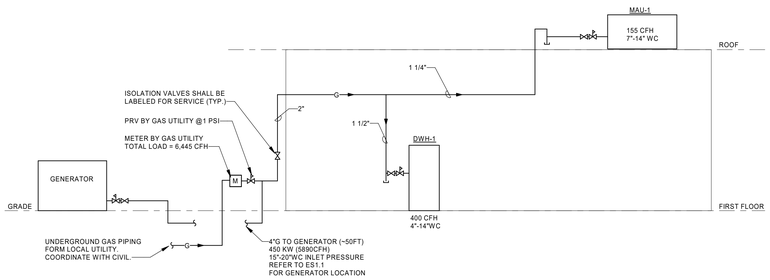
UNIT 200/300/400 GEOTHERMAL SYSTEM PIPING DIAGRAM

NO SCALE

GAS LOAD SUMMARY

EQUIPMENT ID	CFH
DWH-101	400
GENERATOR	5890
MAU-100	155
TOTAL	6445

NOTES:
1. CONTRACTOR TO COORDINATE GAS LOAD AND PRESSURE REQUIREMENTS WITH LOCAL UTILITY COMPANY.
2. CONTRACTOR SHALL VERIFY ALL EQUIPMENT CONNECTION REQUIREMENTS (SIZES, LOCATION, TYPES, ETC.) PRIOR TO COMMENCEMENT OF WORK.
3. 1PSI DELIVERY PRESSURE. DISTRIBUTION OF GAS PIPING IS SIZED FOR A 10% MAXIMUM PRESSURE DROP, BASED ON A TOTAL DEVELOPED LENGTH OF 150 LINEAR FEET SCHEDULE 40 METALLIC PIPE TO FARTHEST EQUIPMENT.



NATURAL GAS RISER DIAGRAM

NO SCALE

HVAC GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE HVAC SYSTEMS COMPLETE PER SPECIFICATION, SMACNA STANDARDS, AND PER APPLICABLE CODES INCLUDING ALL NECESSARY OFFSETS, FITTINGS, SPECIAL RADIUS OR MITERED ELBOWS WHICH ARE REQUIRED DUE TO SPACE CONSTRAINTS OR STRUCTURAL CONDITIONS OR OTHER CONDITIONS.
2. CONTRACTOR SHALL COORDINATE THEIR WORK WITH THE WORK OF ALL OTHER TRADES. ALL DUCTWORK IS TO BE ROUTED AS HIGH AS POSSIBLE. PROVIDE ACCESS AROUND ALL NEW EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL CLEARANCES PRIOR TO THE FABRICATION OF ANY WORK.
3. DUCTWORK/PIPING SHALL BE ROUTED AS HIGH AS POSSIBLE AND SHALL NOT BE LOCATED OVER ELECTRICAL EQUIPMENT/PANELS. PROVIDE REQUIRED CLEARANCE IN FRONT OF ELECTRICAL EQUIPMENT. DUCTWORK/PIPING SHALL NOT INTERFERE WITH ELECTRICAL EQUIPMENT CLEARANCE.
4. DUCTWORK/PIPING SHALL NOT BE INSTALLED IN A LOCATION THAT RESTRICTS THE ACCESS TO MECHANICAL DEVICES REQUIRING ACCESS.
5. THE CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS SUPPORTING STEEL, ETC. FOR THE PROPER INSTALLATION OF ALL MECHANICAL SYSTEMS.
6. COORDINATE FLOOR, WALL, ROOF PENETRATIONS, LOUVER SIZES, PAD LOCATIONS ETC. WITH ARCHITECTURAL TRADES. SEAL ALL PIPING AND DUCT PENETRATIONS.
7. THE CONTRACTOR SHALL REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF GRILLES, REGISTERS, AND DIFFUSERS.
8. COORDINATE AND PROVIDE ACCESS DOORS IN HARD CEILING AREAS FOR ACCESS TO BALANCING DAMPERS, ETC. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
9. BRANCH DUCTWORK TO GRILLES, REGISTERS AND DIFFUSERS SHALL BE THE SAME SIZE AS THE GRILLE, REGISTER OR DIFFUSER NECK SIZE WHERE NO DUCT SIZE IS INDICATED ON PLAN.
10. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL BE 5'-0".
11. FOR EQUIPMENT VALVING, COMPONENT, AND PIPING ARRANGEMENT, REFER TO PIPING DIAGRAMS AND DETAILS.
12. PAINT ALL VISIBLE INTERIOR SURFACES OF EXHAUST/RETURN GRILLES, REGISTERS AND VISIBLE ASSOCIATED DUCTWORK FLAT BLACK.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR DAMPERS, VALVES, AND CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPES.
15. DUCTWORK TO AND FROM VAV BOXES/TERMINAL UNITS SHALL BE EQUAL TO THE BOX CONNECTIONS SIZES UNLESS INDICATED OTHERWISE.
16. CONNECTION TO EQUIPMENT SHALL BE VERIFIED WITH MANUFACTURER'S CERTIFIED DRAWINGS. TRANSITIONS TO ALL EQUIPMENT SHALL BE VERIFIED AND PROVIDED FOR EQUIPMENT FURNISHED.
17. ALL BRANCH PIPING TO TERMINAL UNITS TO BE 3/4" UNLESS OTHERWISE NOTED.
18 AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT PROVIDE A UNION, SHUT-OFF VALVE, TEE WITH SEDIMENT TRAP & PRESSURE TEST PLUG, REGULATOR AND UNION. FOR MEDIUM PRESSURE REGULATORS, AN ADDITIONAL TEE WITH PRESSURE TEST PLUG SHALL BE INSTALLED NOT LESS THAN 10 PIPE DIAMETERS DOWNSTREAM. SEDIMENT TRAPS SHALL BE INSTALLED SUCH THAT THERE IS ROOM BELOW TO REMOVE THE CAP/PLUG AND CLEAN THE TRAP. WEATHERPROOF PAINT ALL EXTERIOR GAS PIPING.
19 AT EACH CONNECTION OF GAS SUPPLY TO EQUIPMENT, PROVIDE A PIPE UNION, GAS SHUT-OFF VALVE, TEE AND 6" LONG DIRT LEG WITH CAP. WEATHERPROOF PAINT ALL GAS PIPING.
20 IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.

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STEVEN K. GUNTHER, JR.
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Lansing School District

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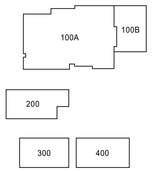

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL RISER DIAGRAMS

SHEET NO.

M7.0

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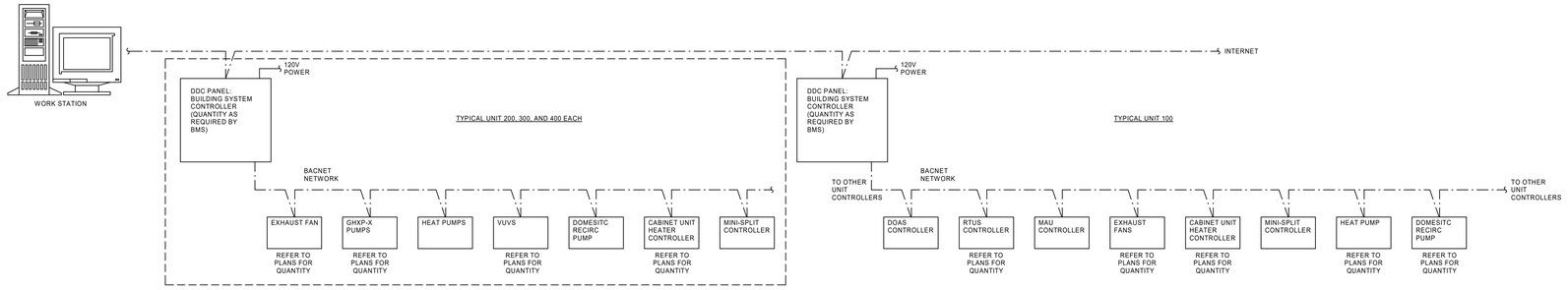
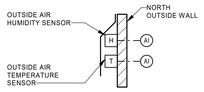
	SENSOR PROBE
	DISCONNECT SWITCH
	AVERAGING SENSOR
	DISPERSION TUBE
	PARALLEL BLADE DAMPER
	OPPOSED BLADE DAMPER
	BACKFLOW DAMPER
FMS	FLOW MEASURING STATION
DPS	BUILDING PRESSURE SENSOR
C	CHILLED WATER COIL
D X	DX COIL
	ELECTRIC HEATING ELEMENT
H X	GAS HEATING COIL
H C	HEATING HOT WATER COIL
	ENERGY RECOVERY WHEEL
	FAN
	PLENUM FAN
	PROP FAN
	PUMP
	FILTER
DPT	SINGLE FILTER WITH DIFFERENTIAL PRESSURE TRANSMITTER
DPT	DOUBLE FILTER WITH DIFFERENTIAL PRESSURE TRANSMITTER

AI	ANALOG INPUT
AO	ANALOG OUTPUT
BI	DIGITAL INPUT
BO	DIGITAL OUTPUT
VP	VIRTUAL POINT
CO2	CARBON DIOXIDE STAT
H	HUMIDISTAT
T	THERMOSTAT
CO2	CARBON DIOXIDE SENSOR
CO	CARBON MONOXIDE SENSOR
H	HUMIDITY SENSOR
NOX	NOX SENSOR
OS	OCCUPANCY SENSOR
T	TEMPERATURE SENSOR
ECM	ELECTRONIC COMMUTATED MOTOR
M	MOTOR STARTER
S	START STOP
VFD	VARIABLE VREQUENCY DRIVE
BI	BIPOLAR IONIZATION
C	CURRENT SENSOR
CFM	CFM SENSOR
CM	CONTROL MODULE
CS	CURRENT SWITCH
CT	CURRENT TRANSDUCER
DPS	DIFFERENTIAL PRESSURE SENSOR
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DS	DOOR SWITCH
ES	END SWTICH
F	FLOW SWITCH
FM	FLOW METER
LL	LOW LIMIT / FREEZE STAT
LS	LIMIT SWITCH
M	DAMPER MOTOR
PS	PRESSURE SWITCH
R	CONTROL RELAY
SD	SMOKE DETECTOR
SP	STATIC PRESSURE
TD	TIME DELAY RELAY



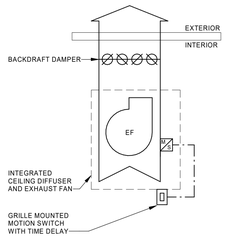
BUILDING MANAGEMENT SYSTEM (BMS) NOTES:

1. THE INTENT IS TO PROVIDE A FULLY FUNCTIONING AND COMPLETE BUILDING MANAGEMENT SYSTEMS (BAS OR BMS) WITH REMOTE/INTERNET ACCESS, GRAPHICAL READOUTS, TREAD DATA, SAFETIES, ALARMS, AND THE LIKE.
2. CONFIGURATION AND ORDER OF CONTROLLER CONNECTION IS FOR REPRESENTATION PURPOSES ONLY. CONTROL SYSTEM DRAWINGS SHALL REFLECT ACTUAL AS-BUILT CONDITIONS, INCLUDING ORDER IN WHICH CONTROLLERS ARE CONNECTED WITHIN THE NETWORK. DDC PANELS ARE SHOWN ON FLOOR PLANS (IN THE MECHANICAL/ELECTRICAL ROOM, STORAGE ROOMS, CUSTODIAL CLOSETS, ETC.) THROUGHOUT THE BUILDING SHALL HAVE 120V CONTROL POWER AT EACH, REFER TO PLANS. IF ADDITIONAL DDC PANELS AND/OR POWER SUPPLIES ARE REQUIRED, IT IS THE TCCS RESPONSIBILITY TO PROVIDE POWER TO THOSE PANELS AND COORDINATE WITH THE ELECTRICAL ENGINEER/CONTRACTOR. IT SHOULD BE NOTED THAT ADDITIONAL ELEMENTS SUCH AS GENERAL VALVES, OTHER NON-ACTIVELY CONTROLLED DEVICES, AND/OR OTHER NETWORK COMMUNICATION DEVICES (SUCH AS CONTACTORS, RELAYS, SWITCHES, HUBS, ROUTERS, ETC.) MAY NOT BE SHOWN ON CONTROLS DRAWINGS. REFER TO THE DETAILS, PROJECT PLANS, AND SPECIFICATIONS FOR ADDITIONAL DEVICES AND INSTRUCTIONS THAT ARE REQUIRED IN THE CONSTRUCTION OF THESE SYSTEMS.
3. ALL CONTROL POINTS SHALL BE TRENDABLE. AFTER THE SYSTEM IS BALANCED, COMMISSIONED, AND OPERATIONAL, TRENDING WILL BE REQUIRED TO VERIFY THE ACCURACY AND ACCEPTABILITY OF THE CONTROL SEQUENCES. PROVIDE ADDITIONAL ADJUSTMENTS AND/OR CHANGES IN STRATEGY IN ORDER TO HONE BUILDING OPERATION AND OPTIMIZE ENERGY USAGE. ALL SET POINTS SHALL BE OPERATOR ADJUSTABLE THROUGH THE BMS AT THE OPERATOR'S WORKSTATION (OWS).
4. PROVIDE PROGRAMMING FOR ADDITIONAL ALARMS AS REQUESTED BY THE OWNER AND/OR ENGINEER.
5. SEE FLOOR PLANS, SPECIFICATIONS, AND SHOP DRAWINGS FOR MINIMUM CLEARANCE OF ALL MECHANICAL EQUIPMENT AND CONTROL DEVICES. MAINTAIN ACCEPTABLE CLEARANCE IN ALL AREAS REQUIRED FOR SERVICE AND ACCESS OF MECHANICAL EQUIPMENT AS PER ANY APPLICABLE CODES AND/OR MANUFACTURER RECOMMENDATIONS. MAINTAIN CODE-REQUIRED MINIMUM CLEARANCES ABOVE AND IN FRONT OF ALL ELECTRICAL PANELS, INCLUDING THOSE INCLUDED AS A PART OF MECHANICAL EQUIPMENT.
6. ALL POINTS INDICATED ON CONTROLS DRAWINGS SHALL BE, AT A MINIMUM, INCLUDED ON GRAPHICS THROUGH BAS.
7. FOR EQUIPMENT PROVIDED WITH BACNET OR MODBUS CONTROLLERS/COMMUNICATION INTERFACES, PROVIDE SUB-GRAPHICS THROUGH THE BAS. THE GRAPHIC SHALL DISPLAY ALL POINTS LISTED IN INDIVIDUAL CONTROL DIAGRAMS. PROVIDE ADDITIONAL READ/WRITE POINTS UPON REQUEST BY THE OWNER FOR SUCH EQUIPMENT.
8. PROVIDE ALL DEVICES SHOWN IN THE DIAGRAMS NOT PROVIDED BY THE UNIT MANUFACTURER AS REQUIRED TO PROVIDE THE DESIRED SEQUENCE OF OPERATION. REFER TO INDIVIDUAL CONTROL DIA.
9. UNLESS OTHERWISE NOTED, ROOM THERMOSTATS AND/OR HUMIDISTATS SHALL HAVE SET-POINT ADJUSTMENT CAPABILITY AND TEMPERATURE/HUMIDITY DISPLAY.



GLOBAL AMBIENT TEMP AND HUMIDITY
NO SCALE

DDC SYSTEM ARCHITECTURE
NO SCALE

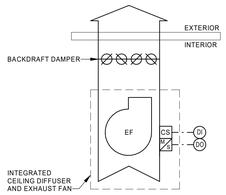


SEQUENCE OF OPERATION:
NOTE: ALL SETPOINTS AND TIME INTERVALS SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR.

CONTROLS TO BE PROVIDED BY UNIT MANUFACTURER.

THE EXHAUST FAN SHALL RUN CONTINUOUSLY AT CONSTANT VOLUME WHEN SWITCH IS FLIPPED ON. EXHAUST FAN WILL RUN FOR AN ADDITIONAL 15 MINS (ADJ.) AFTER SWITCH IS FLIPPED OFF.

CEILING MOUNTED EXHAUST FAN CONTROLS DIAGRAM
NO SCALE

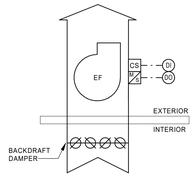


SEQUENCE OF OPERATION:
NOTE: ALL SETPOINTS AND TIME INTERVALS SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR.

CONTROLS TO BE PROVIDED BY UNIT MANUFACTURER.

THE FAN SHALL BE STARTED THROUGH THE BMS AND IS INTENDED TO RUN CONTINUOUSLY AT A CONSTANT VOLUME ON A TIME OF DAY SCHEDULE. IF THE FAN IS COMMANDED ON, BUT NO CURRENT IS SENSED, THE FAN SHALL BE SHUT DOWN AND AN ALARM SHALL BE GENERATED AT THE BMS.

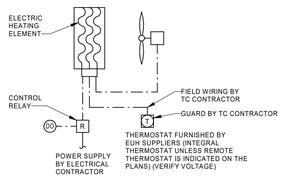
CEILING MOUNTED EXHAUST FAN CONTROLS DIAGRAM
NO SCALE



SEQUENCE OF OPERATION:
NOTE: ALL SETPOINTS AND TIME INTERVALS SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR.

THE FAN SHALL BE STARTED THROUGH THE BMS AND IS INTENDED TO RUN CONTINUOUSLY AT A CONSTANT VOLUME ON A TIME OF DAY SCHEDULE. IF THE FAN IS COMMANDED ON, BUT NO CURRENT IS SENSED, THE FAN SHALL BE SHUT DOWN AND AN ALARM SHALL BE GENERATED AT THE BMS.

ROOF MOUNTED EXHAUST FAN
NO SCALE



CONTROL:

1. UNIT SHALL OPERATE FROM PACKAGED CONTROLS.

TYPICAL ELECTRIC UNIT HEATER AND CABINET UNIT HEATER CONTROL DIAGRAM
NO SCALE

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Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
CONTROL DIAGRAMS

SHEET NO.
M8.0

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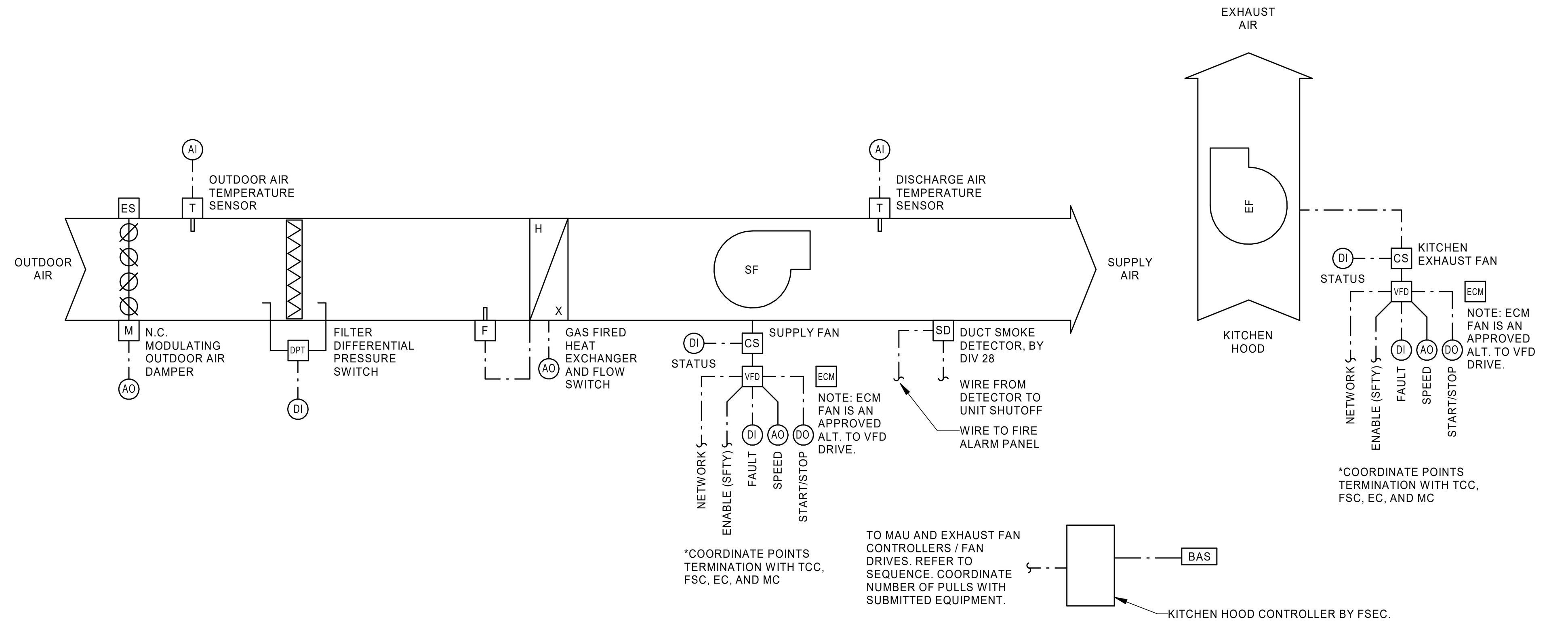


SEQUENCE OF OPERATIONS:

GENERAL

THE KITCHEN HOOD MAKEUP AIR UNIT SEQUENCES HEREIN DEPICT GENERAL INTENT OF OPERATION AND ARE TO BE PERFORMANCE BASED. FOR COMPLETE PROCEDURAL FUNCTIONALITY, THE UNITS SHALL FOLLOW THE GUIDELINES IN ASHRAE 90.1-2013, AHRAE 62.1-2016, MMC-2015, UL 508A, AND IECC 403.2.8-2015 WITHOUT EXPLICIT STATEMENT. IMPLEMENTATIONS THAT PROVIDE THE SAME FUNCTIONAL RESULTS USING DIFFERENT UNDERLYING DETAILED LOGIC WILL BE ACCEPTABLE.

CONTROLS TO BE SUPPLIED BY THE TEMPERATURE CONTROLS CONTRACTOR AND COORDINATED WITH THE FOOD SERVICE CONTRACTOR.

AT MINIMUM, PROVIDE A GRAPHICAL REPRESENTATION OF THE DIAGRAM AND ASSOCIATED POINTS INDICATED ABOVE AT THE BAS. ALL ADDITIONAL POINTS NOT STRICTLY REQUIRING GRAPHICAL REPRESENTATION, SHALL STILL BE READ/WRITE ACCESSIBLE AT THE OWS/BAS. ALL SETPOINTS, TIMERS, DEADBANDS, SCHEDULES, ETC. LISTED HEREIN THE SEQUENCE SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR. VALUES FOR ALL POINTS, INCLUDING HARDWARE POINTS, SHALL BE OVERRIDABLE. EXCEPTIONS CAN BE MADE REGARDING MACHINE OR LIFE SAFETY.

EQUIPMENT MOTORS INTENDED TO BE MODULATED CAN BE PROVIDED WITH EITHER VARIABLE FREQUENCY DRIVES OR ELECTRONIC COMMUTATED MOTOR; SEQUENCE MAY USED INTERCHANGEABLE.

THE HOOD CONTROL PANEL SOO

THE HOOD CONTROL SEQUENCE HEREIN ARE FOR REFERENCE AND ARE TO BE PROVIDED AND FINALLIZED BY FOOD SERVICE CONTRACTOR. S.O.O. IS BASED ON B.O.D. HOOD MANUFACTURER: CAPTIVEAIRE. REFER TO FOOD SERVICE DRAWINGS AND SPECIFICATIONS.

THE HOOD CONTROL PANEL IS CAPABLE OF OPERATING IN ONE OR MORE OF THE FOLLOWING STATES AT ANY GIVEN TIME:

1. AUTOMATIC: THE SYSTEM OPERATES BASED ON A DIFFERENTIAL BETWEEN ROOM TEMPERATURE AND THE AIR TEMPERATURE AT THE HOOD CAVITY OR EXHAUST DUCT COLLAR. THE FANS SHALL ACTIVATE AT A CONFIGURABLE TEMPERATURE DIFFERENTIAL THRESHOLD. THE FANS SHALL BE VARIABLE SPEED AND THE FAN ZONE DEFINED AS STATIC. FANS WILL RUN AT A SET SPEED CALCULATED FOR THE DRIVE.
2. MANUAL: THE SYSTEM OPERATES BASED ON HUMAN INPUT FORM AN HMI
3. SCHEDULE: A WEEKLY SCHEDULE CAN BE SET TO RUN FANS FOR A SPECIFIED PERIOD THROUGHOUT THE DAY.
4. OTHER: THE SYSTEM OPERATES BAED ON THE INPUT FROM AN EXTERNAL SOURCE (DDC, BMS, OR HARD-WIRED INTERLOCK)
5. FIRE: UPON ACTIVATION OF THE HOOD FIRE SUPPRESSION SYSTEM, THE EXHAUST FAN WILL COME ON OR CONTINUE TO RUN, THE HOOD MAKEUP AIR WILL SHUTDOWN, AND A SIGNAL WILL BE SENT FOR ACTIVATION THE SHUNT TRIP BREAKER. FUEL GAS WILL SHUT OFF VIA A MECHANICAL/ELECTRICAL GAS VALVE ACTUATED BY THE HOOD FIRE SUPPRESSION SYSTEM.

NOTE - KITCHEN HOOD CONTROLLER, ROOM SENSOR, HOOD TEMPERATURE SENSOR, DUCT COLLAR SENSOR, KITCHEN HOOD CHEMICAL FIRE PROTECTION SYSTEM, SHUNT TRIPS, AND GAS SOLENIOD VALVES TO BE BY FSC.

SUPPLY FAN, DAMPER, AND SUPPLY AIR TEMPERATURE CONTROL:

THE SUPPLY FAN SHALL RUN AT DESIGN AIRFLOWS WHEN THE SYSTEM IS CALLED TO OPERATE BY THE KITCHEN HOOD CONTROLLER IN ONE OF ITS PROGRAMED OPERATING MODES. WHEN THERE IS NO CALL TO OPERATE, THE OUTDOOR AIR DAMPERS SHALL BE FULLY CLOSED. THE SUPPLY FAN SHALL BE OFF.

THE SUPPLY FAN SHALL ONLY OPERATE WHILE THE EXHAUST FAN IS RUNNING.

PRIOR TO START AND OPERATION OF THE SUPPLY FAN, THE OUTDOOR AIR DAMPER SHALL OPEN.

AS DISCHARGE AIR TEMPERATURE DECREASES BELOW 62ºF, THE UNIT SHALL ENABLE AND MODULATE THE GAS BURNER TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT OF 65ºF MINIMUM.

HARD INTERLOCK VFD AND DAMPER TO KITCHEN HOOD CONTROLLER.

KITCHEN EXHAUST FAN CONTROL:

THE KITCHEN EXHAUST FAN SHALL RUN WHEN THE SYSTEM IS CALLED TO OPERATE BY THE KITCHEN HOOD CONTROLLER IN ONE OF ITS PROGRAMED OPERATING MODES. WHEN THERE IS NO CALL TO OPERATE, THE EXHAUST FAN SHALL BE SHUT OFF.

PREP MODE: THE SYSTEM SHALL OPERATE IN PREP MODE DURING OCCUPIED HOURS, LIGHT COOKING APPLICATIONS, OR COOL DOWN MODE WHEN SUFFICIENT HEAT REMAINS UNDERNEATH THE HOOD SYSTEM AFTER COOKING OPERATIONS HAVE COMPLETED. OPERATION DURING THESE PERIODS WILL DISABLE THE SUPPLY FANS AND PROVIDE AN EXHAUST FAN SPEED EQUAL TO THE MINIMUM VENTILATION REQUIREMENTS.

HARD INTERLOCK VFD TO KITCHEN HOOD CONTROLLER.

FIRE ALARM MODE CONTROL:

THE SUPPLY FAN SHALL SHUT DOWN WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL VIA THE FIRE ALARM CONTROL MODULE. NEXT, THE OUTDOOR AIR DAMPER SHALL CLOSE AND THE UNIT SHALL BE DISABLED.

SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

ALARMS AND SAFETIES

PROVIDE ALL RELEVANT ALARMS TO NOTIFY SYSTEM OPERATORS OF MAINTENANCE, PERFORMANCE, EQUIPMENT, OR LIFE-SAFETY ERRORS AND FAULTS. REFER TO MANUFACTURER INFORMATION AND CODE REQUIREMENTS FOR ADDITIONAL SAFETIES AND ALARMS.

DUCT SMOKE DETECTOR: WHEN SMOKE IS DETECTOR, DISABLE SUPPLY FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

FILTER DIFFERENTIAL SWITCH: WHEN DIFFERENTIAL PRESSURE ACROSS THE FILTERS EXCEEDS ALLOWABLE LIMIT, GENERATE AN ALARM AT THE BAS.

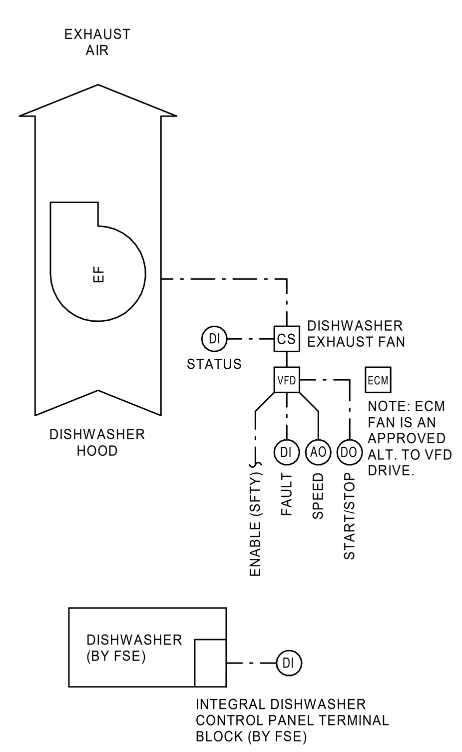
FAN STATUS: THE BAS SHALL MONITOR FAN CURRENT SWITCHES. IF STATUS DOES NOT MATCH COMMAND OUTPUT, DISABLE FAN AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

DAMPER POSITION: KNOWLEDGE OF DAMPER POSITION SHALL BE REQUIRED; A MODULATING (ANALOG) ACTUATOR OR FLOATING ACTUATOR CAN BE USED. IF DAMPER POSITION IS DETERMINED BY THE BAS TO BE INCORRECT, GENERATE AN ALARM AT THE BAS.

OUTDOOR AIR DAMPER POSITION: THE OUTDOOR AIR DAMPER SHALL FAIL CLOSED. IF THE OUTDOOR AIR DAMPER FAILS TO OPEN/MODULATE, AS INDICATED BY THE END SWITCH, GENERATE AN ALARM AT THE BAS.

DISCHARGE AIR TEMPERATURE: IF DISCHARGE AIR TEMPERATURE FALLS OUT OF THE ALLOWABLE RANGE OF 5°F FOR A TIME PERIOD 10 MINUTES, GENERATE AN ALARM AT THE BAS.

KITCHEN MAKEUP AIR UNIT AND EXHAUST FAN
NO SCALE



SEQUENCE OF OPERATION:
NOTE: ALL SETPOINTS AND TIME INTERVALS SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR.

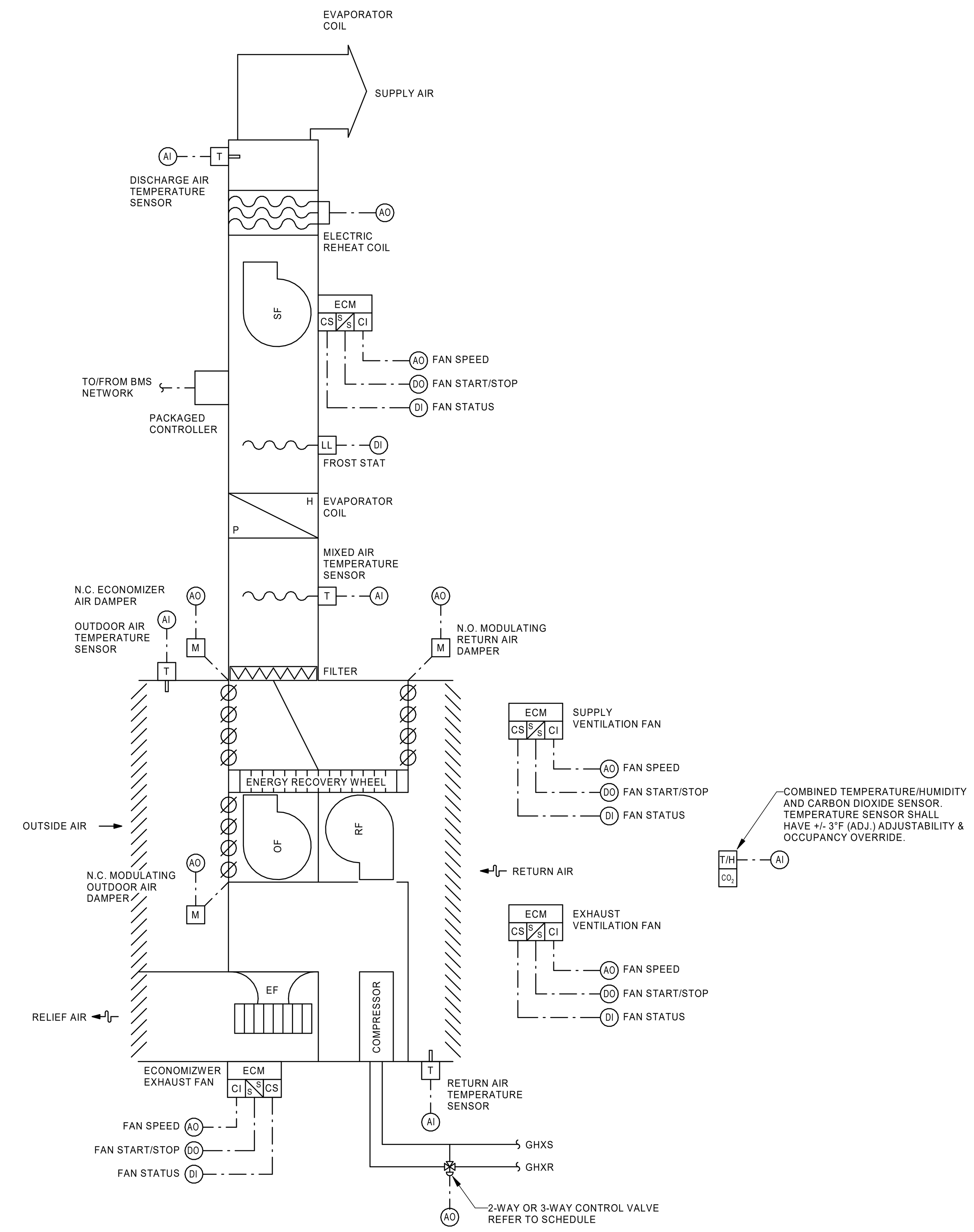
THE DISHWASHER STATUS SHALL BE MONITORED BY THE BMS.

THE FAN SHALL BE STARTED THROUGH THE BMS AND IS INTENDED TO RUN CONTINUOUSLY AT A CONSTANT VOLUME WHENEVER THE DISHWASHER IS IN OPPERATION.

IF THE FAN IS COMMANDED ON, BUT NO CURRENT IS SENSED, THE FAN SHALL BE SHUT DOWN AND AN ALARM SHALL BE GENERATED AT THE BMS.

FAN SHALL BE COMMANDED OFF IF THE FIRE SUPPRESSION SYSTEM IS ACTIVATED WITHIN THE KITCHEN.

DISHWAHSER EXHAUST FAN CONTROLS DIAGRAM
NO SCALE



SEQUENCE OF OPERATIONS:

PACKAGED CONTROLLER

TEMPERATURE CONTROLS SHALL BE FACTORY MOUNTED AND PROVIDED BY THE UNIT MANUFACTURER.

THE UNIT SHALL BE FITTED WITH A PROGRAMMABLE MICROPROCESSOR CONTROLLER PROVIDED BY THTE UNIT MANUFACTURER MOUNTED OUTSIDE THE AIR STREAM IN THE CONTROL PANEL. THE CONTROLLER SHALL BE DESIGNED SPECIFICALLY TO OPPERATE THE UNIT AND ALL FEATURES STATED BELOW OR LISTED IN THE SCHEDULE IN THE MOST ENERGY EFFICENT MANNER USING PRE-ENGINEERED CONTROLS STRATEGIES.

THE UNIT SHALL BE CAPABLE OF PROVIDING HEATING, COOLING, AND VENTILATION TO MAINTAIN SPACE TEMPERATURE BASED ON THE STATED SETPOINTS WITH +/- 3 DEGREE ADJUSTMENT. HEATING AND COOLING SHALL BE PROVIDED BY AN INTEGRAL GEOTHERMAL HEAT PUMP WITH 2-WAY CONTROL VALVES ON THE GXHR LINE. IN ADDITION, ELECTRIC REHEAT COIL CONTROLS SHALL BE PROVIDED IN CASES WHERE HEATPUMP CANNOT MEET DEMAND. HOT GAS REHEAT CONTROL SHALL BE PROVIDED FOR HUMIDITY CONTROL. THE SUPPLY FAN SHALL BE CONTROLLED BASED ON HIGH/LOW SPEED ADJUSTMENT. ENERGY RECOVERY WHEEL CONTROL WITH DEDICATED VENTILATION AND EXHAUST FANS SHALL BE PROVIDED. PROVIDE CONTROLS FOR CO2 CONTROL. ECONOMIZER CONTROL SHALL BE PROVIDED AND ENGAGE THE GENERAL EXHAUST FAN.

DDC PANEL

ALL VUVS SHALL BE MONITORED/SHOWN BY THE BUILDING MANAGEMENT SYSTEM (BMS). AT MINIMUM, PROVIDE A GRAPHICAL REPRESENTATION OF THE DIAGRAM AND ASSOCIATED POINTS INDICATED ABOVE.

OCCUPIED AND UNOCCUPIED MODES:

THE CONTROLLER SHALL EITHER RECEIVE A SIGNAL FROM BMS OR HAVE NATIVE TO THE CONTROLLER A WEEKLY DRIVEN, TIME-OF-DAY SCHEDULER FOR OCCUPIED AND UNOCCUPIED OPERATION TIMES.

SETPOINTS

DEFAULT CONTROL TEMPERATURE SETPOINTS SHALLBE:
- OCCUPIED 72.0°F COOLING, 70.0°F HEATING (ADJ)
- UNOCCUPIED 85.0°F COOLING, 62.0°F HEATING (ADJ)

ALARMS

PROVIDE THE FOLLOWING ALARMS: THERMOSTAT ALARMS, CONDENSATE FLOAT SWITCH ALARM, FROST STAT ALARM, SUPPLY FAN STATUS ALARM, CONDENSER FAN STATUS ALARM, DIRTY FILTER ALARM, LOW PRESSURE ALARM, HIGH PRESSURE ALARM, LOW INDOOR COIL TEMP ALARM, LOW COAX. COIL OUTLET TEMP. ALARM, EXHAUST FAN STATUS ALARM, AND ERM WHEEL STATUS ALARM.

PROVIDE ANY ADDITIONAL ALARMS RECOMMENDED BY THE MANUFACTURER OR REQUEST BY THE OWNER. INTEGRATE ALL POINTS INTO THE BMS.

FIRE ALARM MODE CONTROL:

THE SUPPLY FAN SHALL SHUT DOWN AND OUTDOOR AIR DAMPERS SHALL CLOSE WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL. SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

VERTICAL UNIT VENTILATOR W/ SELF-CONTAINED HP AND ERW CONTROL DIAGRAM
NO SCALE

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STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
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01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
CONTROL DIAGRAMS

SHEET NO.
M8.1

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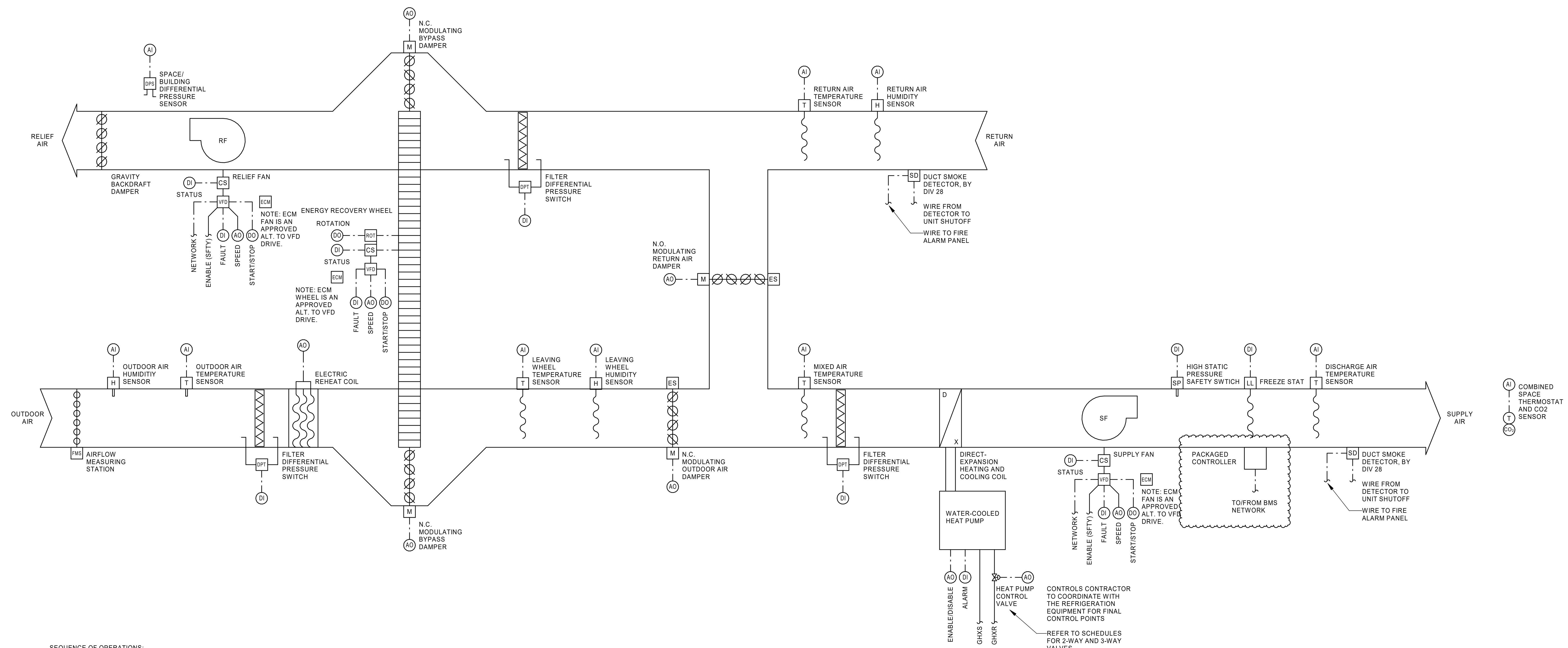

SEQUENCE OF OPERATIONS:

GENERAL

THE SINGLE-ZONE VAV AIR-HANDLING UNIT SEQUENCES HEREIN DEPICT GENERAL INTENT OF OPERATION AND ARE TO BE PERFORMANCE BASED. FOR COMPLETE PROCEDURAL FUNCTIONALITY, THE UNITS SHALL FOLLOW THE GUIDELINES IN ASHRAE 90.1-2013 CHAPTER 6, AHRAE 62.1-2016, AND ASHRAE GUIDELINE 36 CHAPTERS 5.1-5.4, 5.15, AND 5.18 WITHOUT EXPLICIT STATEMENT. IMPLEMENTATIONS THAT PROVIDE THE SAME FUNCTIONAL RESULTS USING DIFFERENT UNDERLYING DETAILED LOGIC WILL BE ACCEPTABLE.

UNIT SHALL BE PROVIDED WITH MANUFACTURER CONTROLS. THE TEMERPATURE CONTROLS CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL CONTROL POINTS ARE PROVIDED AND THE SEQUENCE OF OPERATIONS IS MET AS INDICATED ON THIS SHEET. IF UNIT IS NOT SUPPLIED WITH CERTAIN POINTS/ACCESSORIES REQUIRED TO MEET SEQUENCE, IT IS THE RESPONSIBILITY OF THE TEMPERATURE CONTROLS CONTRACTOR TO PROVIDE NECESSARY ITEMS.

AT MINIMUM, PROVIDE A GRAPHICAL REPRESENTATION OF THE DIAGRAM AND ASSOCIATED POINTS INDICATED ABOVE. ALL ADDITIONAL POINTS NOT STRICTLY REQUIRING GRAPHICAL REPRESENTATION, SHALL STILL BE READ/WRITE ACCESSIBLE AT THE OWS/BAS. ALL SETPOINTS, TIMERS, DEADBANDS, SCHEDULES, ETC. LISTED HEREIN THE SEQUENCE SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR. VALUES FOR ALL POINTS, INCLUDING HARDWARE POINTS, SHALL BE OVERRIDABLE. EXCEPTIONS CAN BE MADE REGARDING MACHINE OR LIFE SAFETY.

EQUIPMENT MOTORS INTENDED TO BE MODULATED CAN BE PROVIDED WITH EITHER VARIABLE FREQUENCY DRIVES OR ELECTRONIC COMMUTATED MOTOR; SEQUENCE MAY USED INTERCHANGEABLE.

THE ROOFTOP UNIT SHALL BE CAPABLE OF OPERATING IN THE FOLLOWING MODES AS DETERMINED BY THE ZONE GROUPS ASSOCIATED WITH THE UNIT: (1) OCCUPIED, (2) COOLDOWN, (3) UNOCCUPIED COOLING, (4) WARMUP, (5) UNOCCUPIED HEATING, AND (6) UNOCCUPIED MODE.

MINIMUM DISCHRAGE AIR TEMPERATURE SETPOINT SHALL BE 55ºF (ADJ.) **MAXIMUM DISCHARGE AIR TEMPERATURE** SHALL BE 95ºF (ADJ.)

UNOCCUPIED CONTROL:

DURING UNOCCUPIED MODE, THE OUTDOOR AIR DAMPER SHALL BE FULLY CLOSED. THE RETURN AIR DAMPER SHALL BE FULLY OPEN. THE SUPPLY FAN SHALL BE OFF. THE TEMPERATURE CONTROL LOOP SHALL BE SET TO DEADBAND.

DURING UNOCCUPIED MODE, THE AHU CONTROLLER OR BAS SHALL CONTINUOUSLY POLL THE ZONE TEMPERATURE SENSOR. IF THE ZONE TEMPERATURE SENSOR FALLS OUTSIDE OF THE UNOCCUPIED SETPOINT RANGES, THE UNIT SHALL BE ENABLED AND RUN IN UNOCCUPIED HEATING OR UNOCCUPIED COOLING MODES UNTILL THE UNOCCUPIED SETPOINTS ARE 1ºF ABOVE OR BELOW UNOCCUPIED SETPOINT RESPECTIVELY.

WHEN UNOCCUPIED COOLING MODE IS INITIATED BY THE AHU CONTROLLER OR BAS, THE SUPPLY AIR TEMPERATURE CONTROL LOOP SHALL BE ENABLED AND OPERATE TO MAINTAIN **MINIMUM DISCHARGE AIR TEMPERATURE** AS MEASURED AT THE DISCHARGE AIR TEMPERATURE SENSOR.

WHEN UNOCCUPIED HEATING MODE IS INITIATED BY THE AHU CONTROLLER OR BAS, THE SUPPLY AIR TEMPERATURE CONTROL LOOP SHALL BE ENABLED AND OPERATE UP TO A **MAXIMUM DISCHARGE AIR TEMPERATURE** AS MEASURED AT THE DISCHARGE AIR TEMPERATURE SENSOR. THE OUTDOOR AIR DAMPER SHALL BE FULLY CLOSED. THE RETURN AIR DAMPER SHALL BE FULLY OPEN.

FACILITY COOLDOWN / WARMUP CONTROL:

THE FACILITY COOLDOWN / WARMUP SEQUENCES SHALL USE A CALCULATED OPTIMIZED START ROUTINE PRIOR TO SCHEDULED OCCUPIED MODE. THE MORNING WARM-UP / COOL-DOWN ROUTINE SHALL BE INITIATED BY THE BAS. DEFAULT FACILITY COOLDOWN / WARMUP START TIME SHALL BE SIXTY MINUTES.

DURING FACILITY COOLDOWN / WARMUP MODE, THE OUTDOOR AIR DAMPER SHALL BE FULLY CLOSED. THE RETURN AIR DAMPER SHALL BE FULLY OPEN. EXCEPTION: IF ECONOMIZER MODE WOULD RESULT IN AN OVERALL MECHANICAL ENERGY SAVINGS, THEN OUTDOOR AIR DAMPER SHALL BE OPENED.

WHEN FACILITY COOLDOWN MODE IS INITIATED BY THE AHU CONTROLLER OR BAS, THE SUPPLY AIR TEMPERATURE CONTROL LOOP SHALL BE ENABLED AND OPERATE TO MAINTAIN **MINIMUM DISCHARGE AIR TEMPERATURE** AS MEASURED AT THE DISCHARGE AIR TEMPERATURE SENSOR.

WHEN FACILITY WARMUP MODE IS INITIATED BY THE AHU CONTROLLER OR BAS, THE SUPPLY AIR TEMPERATURE CONTROL LOOP SHALL BE ENABLED AND OPERATE UP TO THE **MAXIMUM DISCHARGE AIR TEMPERATURE** AS MEASURED AT THE DISCHARGE AIR TEMPERATURE SENSOR. NOTE: ZONE REHEAT SHALL BE THE SECOND STAGE OF HEATING (AS REQUIRED).

FACILITY COOLDOWN/ WARMUP MODES SHALL SWTICH TO OCCUPIED MODE OPPERATION ONCE THE SPACE TEMPERATURE REACHES THE OCCUPIED SETPOINT OR OCCUPIED TIME.

OUTDOOR AIR CONTROL:

WHEN IN OCCUPIED MODE, THE AHU CONTROLLER OR BAS SHALL INCLUDE MEANS TO AUTOMATICALLY REDUCE OUTDOOR AIR INTAKE AIRFLOW BELOW DESIGN RATES IN RESPONSE TO CHANGES IN SPACE CO2 CONCENTRATION LEVELS.

UPON RISING CO2 CONCENTRATION LEVELS, THE OUTDOOR AIR DAMPER ACTUATOR SHALL MODULATE OPEN. THE AHU OUTDOOR DAMPER ACTUATOR SHALL NOT MODULATE BEYOND ITS SCHEDULED MAXIMUM VENTILATION SETPOINT (SEE VENTILATION SCHEDULE) UNLESS IN ECONOMIZER MODE.

INVERSELY, UPON FALLING CO2 CONCENTRATION LEVELS, THE OUTDOOR AIR DAMPER ACTUATOR SHALL MODULATE CLOSED. DAMPER POSITION LIMITED TO NO LESS THAN THE BUILDING COMPONENT OUTDOOR AIRFLOW.

OUTDOOR AIRFLOW RATE SHALL BE MEASURED BY AN AIRFLOW MEASURING DEVICE.

ECONOMIZER (DRY-BULB):

DURING UNOCCUPIED MODE, THE BYPASS DAMPER(S) SHALL BE CLOSED.

WHILE IN OCCUPIED MODE, IF THE OUTDOOR AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE, THE UNIT SHALL MODULATE THE BYPASS DAMPER TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AND MINIMIZE THE TOTAL MECHANICAL COOLING. THE ECONOMIZER IS THE FIRST STAGE OF COOLING. THE WHEEL SHALL STOP.

IF THE OUTDOOR AIR TEMPERATURE EXCEEDS RETURN AIR TEMPERATURE OR IF THE OUTDOOR AIR TEMPERATURE EXCEEDS 75°F, THE BYPASS DAMPER SHALL CLOSE.

IF THE OUTDOOR AIR TEMPERATURE IS LOWER THAN 45°F, THE BYPASS DAMPER(S) SHALL CLOSE.

ENTHALPY WHEEL CONTROL:

DURING UNOCCUPIED MODE, THE ENTHALPY WHEEL SHALL BE STOPPED.

IN OCCUPIED MODE, IF THE OUTDOOR AIR ENTHALPY (CALCULATED) IS GREATER THAN THE RETURN AIR ENTHALPY (CALCULATED) OR IF THE OUTDOOR AIR TEMPERATURE EXCEEDS 75°F, THE UNIT SHALL MODULATE THE ENTHALPY WHEEL TO MAX SPEED. AT CONDITION, THE ENTHALPY WHEEL SHALL BE THE FIRST STAGE OF COOLING.

IN OCCUPIED MODE, WHENEVER THE OUTDOOR AIR TEMPERATURE IS LESS THAN THE DISCHARGE AIR TEMPERATURE, THE ENTHALPY WHEEL SHALL MODULATE SPEED TO MAINTAIN REQUIRED DISCHARGE TEMPERATURE. THE ENTHALPY WHEEL SHALL BE THE FIRST STAGE OF HEATING.

IF UNIT HAS PACKAGED CONTROLS, MANUFACTURER SEQUENCES SHALL GOVERN.

ENTHALPY WHEEL DEFROST CONTROL:

THE UNITS CONTROLLER SHALL PROVIDE MEANS TO PROTECT WHEEL FROM FROSTING. THE UNIT SHALL USE AN ELECTRIC PREHEAT COIL TO PRETREAT THE OUTDOOR AIR PRIOR TO ENTERING THE WHEEL WHENEVER FROST CONDITIONS ARE POSSIBLE. CONTROLS CONTRACTOR SHALL CONSULT MANUFACTURERS LITTERATURE.

FIRE ALARM MODE CONTROL:

THE SUPPLY FAN SHALL SHUT DOWN WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL VIA THE FIRE ALARM CONTROL MODULE. NEXT, THE OUTDOOR AIR DAMPER SHALL CLOSE AND THE UNIT SHALL BE DISABLED.

SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

RELIEF FAN CONTROL:

PROVIDE OFFSET TO MAINTAIN BUILDING POSITIVE BUILDING PRESSURE (0.03 - 0.05 IN W.C.).

ENABLE, DISABLE, AND MODULATE EXHAUST FAN BASED ON BUILDING PRESSURE CONTROL. REFER TO ASHRAE G36 5.16.9.

SETPOINTS:

UNOCCUPIED SPACE COOLING SETPOINT SHALL BE 80ºF (ADJ.)
UNOCCUPIED SPACE HEATING SETPOINT SHALL BE 65ºF (ADJ.)
OCCUPIED SPACE COOLING SETPOINT SHALL BE 75ºF (ADJ.) 60% RH* (ADJ.)
OCCUPIED SPACE HEATING SETPOINT SHALL BE 70ºF (ADJ.)

*RELATIVE HUMIDITY WILL NOT BE DIRECTLY CONTROLLED. THIS IS A CONDITION THAT CAN BE EXPECTED UNDER NORMAL OPERATING CONDITIONS.

SUPPLY FAN AND SUPPLY AIR TEMPERATURE CONTROL:

SUPPLY FAN SPEED AND TEMPERATURE SEQUENCE SHALL IMPLEMENT ASHRAE G36 SECTION 5.18.4 AND GENERALLY FOLLOW THE LOGIC BELOW:

THE SUPPLY FAN SHALL RUN WHEN THE SYSTEM IS OPERATING IN ALL MODES EXCEPT UNOCCUPIED MODE.

THE SUPPLY FAN SHALL BE AUTOMATICALLY STARTED AND STOPPED BY THE AHU CONTROLLER OR BAS.

UPON PROOF OF SUCCESSFUL START AND OPERATION OF THE SUPPLY FAN, THE OUTDOOR AIR DAMPER SHALL OPEN TO ITS MINIMUM POSITION INITIALLY.

PROVIDE A RAMP FUNCTION TO PREVENT CHANGES IN FAN SPEED OF MORE THAN 10% PER MIN.

AS SPACE TEMPERATURE INCREASES, THE HEAT PUMP CONTROL VALVE SHALL OPEN FULLY. THE UNIT SHALL THEN MODULATE ECONOMIZER DAMPERS (WHEN ECONOMIZER MODE IS ENABLED) AND/OR SHALL MODULATE THE HEAT PUMP SYSTEM TO MAINTAIN SPACE TEMPERATURE SETPOINT. THE COOLING SYSTEM WILL CONTINUE TO MODULATE UP UNTIL THE DISCHARGE AIR TEMPERATURE REACHES THE **MINIMUM DISCHARGE AIR TEMPERATURE**. AT WHICH POINT, BOTH THE MECHANICAL COOLING SYSTEM AND THE SUPPLY FAN WILL MODULATE UP TOGETHER TO MAINTAIN SPACE AIR TEMPERATURE SETPOINT AND **MINIMUM DISCHARGE AIR TEMPERATURE**.

AS SPACE TEMPERATURE BEGINS TO DECREASES, THE PROCESS SHALL WORK IN REVERSE ORDER.

AS SPACE TEMPERATURE DECREASES, THE HEAT PUMP CONTROL VALVE SHALL OPEN FULLY. THE UNIT SHALL THEN MODULATE THE HEAT PUMP SYSTEM TO MAINTAIN SPACE TEMPERATURE SETPOINT. THE HEATING SYSTEM WILL CONTINUE TO MODULATE UP UNTIL THE DISCHARGE AIR TEMPERATURE REACHES THE **MAXIMUM DISCHARGE AIR TEMPERATURE**. AT WHICH POINT, BOTH THE MECHANICAL HEATING SYSTEM AND THE SUPPLY FAN WILL MODULATE UP TOGETHER TO MAINTAIN SPACE AIR TEMPERATURE SETPOINT AND **MAXIMUM DISCHARGE AIR TEMPERATURE**.

AS SPACE TEMPERATURE BEGINS TO INCREASE, THE PROCESS SHALL WORK IN REVERSE ORDER.

ALARMS AND SAFETIES

PROVIDE ALL RELEVANT ALARMS TO NOTIFY SYSTEM OPERATORS OF MAINTENANCE, PERFORMANCE, EQUIPMENT, OR LIFE-SAFETY ERRORS AND FAULTS. REFER TO MANUFACTURER INFORMATION, CODE REQUIREMENTS, AND ASHRAE 36 RECOMMENDATIONS FOR ADDITIONAL SAFETIES AND ALARMS.

HIGH STATIC PRESSURE SAFETY SWTICH: WHEN THE SAFETY SWITCH IS TRIPPED, DISABLE SUPPLY FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE. HIGH PRESSURE SHALL BE SET TO TRIP AT 4" W.G. AND SHALL BE RESET MANUALLY AT THE UNIT.

FREEZE STAT: WHEN A FREEZE CONDITION OCCURS, DISABLE SUPPLY FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE. FREEZE STAT SHALL BE SET TO TRIP AT 40°F AND SHALL BE RESET MANUALLY AT THE UNIT.

DUCT SMOKE DETECTOR: WHEN SMOKE IS DETECTED, DISABLE SUPPLY FAN AND RELIEF FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

FILTER DIFFERENTIAL SWTICH: WHEN DIFFERENTIAL PRESSURE ACCROSS THE FILTERS EXCEEDS ALLOWABLE LIMIT, GENERATE AN ALARM AT THE BAS.

FAN STATUS: THE BAS SHALL MONITOR FAN CURRENT SWITCHES. IF STATUS DOES NOT MATCH COMMAND OUTPUT, DISABLE FAN AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

DAMPER POSITION: KNOWLEDGE OF DAMPER POSITION SHALL BE REQUIRED; A MODULATING (ANALOG) ACTUATOR OR FLOATING ACTUATOR CAN BE USED. IF DAMPER POSITION IS DETERMINED BY THE BAS TO BE INCORRECT, GENERATE AN ALARM AT THE BAS.

VALVE POSITION: KNOWLEDGE OF VALVE POSITION SHALL BE REQUIRED. IF VALVE POSITION IS DETERMINED BY THE BAS TO BE INCORRECT, GENERATE AN ALARM AT THE BAS.

OUTDOOR AIR DAMPER POSITION: THE OUTDOOR AIR DAMPER SHALL FAIL CLOSED. IF THE OUTDOOR AIR DAMPER FAILS TO OPEN/MODULATE, AS INDICATED BY THE END SWITCH, GENERATE AN ALARM AT THE BAS.

RETURN AIR DAMPER POSITION: THE RETURN AIR DAMPER SHALL FAIL OPEN. IF THE RETURN AIR DAMPER FAILS TO CLOSE/MODULATE, AS INDICATED BY THE END SWITCH, GENERATE AN ALARM AT THE BAS.

DISCHARGE AIR TEMPERATURE: IF DISCHARGE AIR TEMPERATURE FALLS OUT OF THE ALLOWABLE RANGE OF 5°F FOR A TIME PERIOD 10 MINUTES, GENERATE AN ALARM AT THE BAS.

SINGLE-ZONE VAV RTU W/ WSHP, ERW CONTROLS DIAGRAM
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
CONTROL DIAGRAMS

SHEET NO.
M8.2

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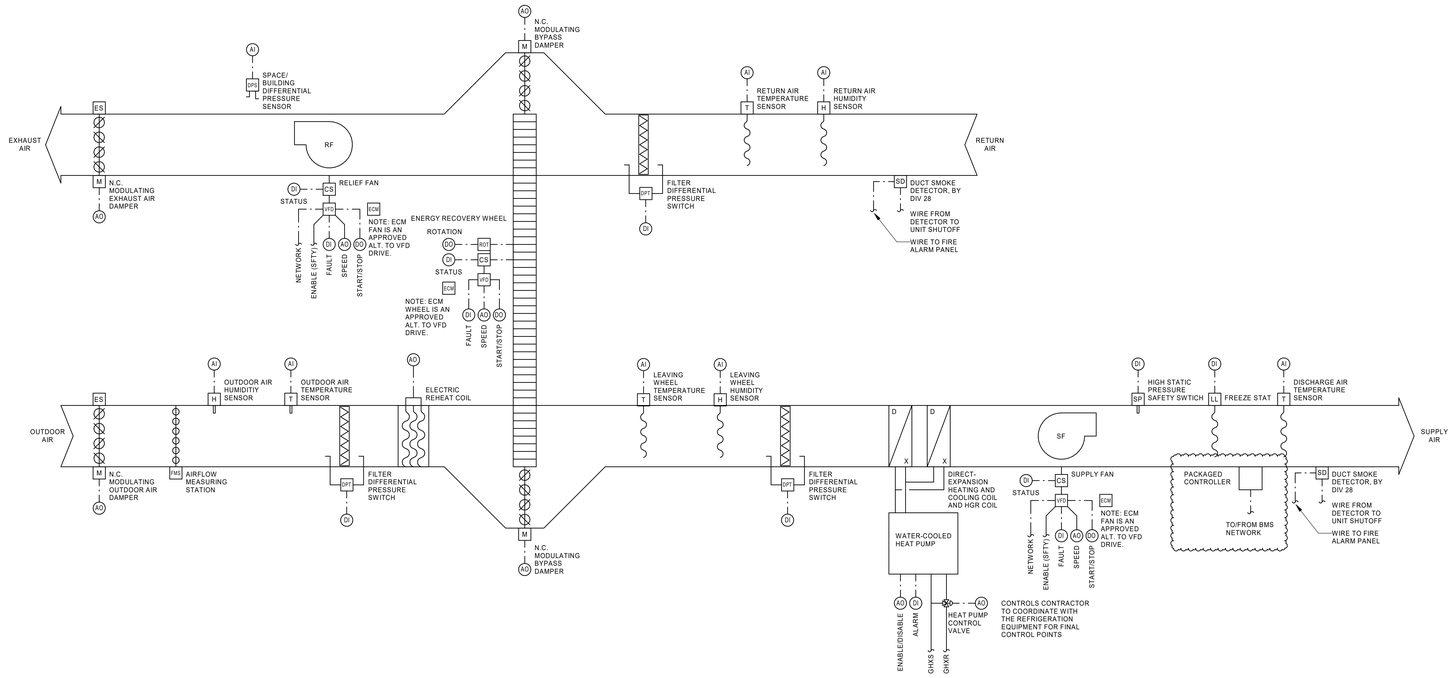

SEQUENCE OF OPERATIONS:

GENERAL

THE DEDICATED OUTDOOR AIR UNIT (DOAS) SEQUENCES HEREIN DEPICT GENERAL INTENT OF OPERATION AND ARE TO BE PERFORMANCE BASED. IMPLEMENTATIONS THAT PROVIDE THE SAME FUNCTIONAL RESULTS USING DIFFERENT UNDERLYING DETAILED LOGIC WILL BE ACCEPTABLE.

UNIT SHALL BE PROVIDED WITH MANUFACTURER CONTROLS. THE TEMERPATURE CONTROLS CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL CONTROL POINTS ARE PROVIDED AND THE SEQUENCE OF OPERATIONS IS MET AS INDICATED ON THIS SHEET. IF UNIT IS NOT SUPPLIED WITH CERTAIN POINTS/ACCESSORIES REQUIRED TO MEET SEQUENCE, IT IS THE RESPONSIBILITY OF THE TEMPERATURE CONTROLS CONTRACTOR TO PROVIDE NECESSARY ITEMS.

AT MINIMUM, PROVIDE A GRAPHICAL REPRESENTATION OF THE DIAGRAM AND ASSOCIATED POINTS INDICATED ABOVE. ALL ADDITIONAL POINTS NOT STRICTLY REQUIRING GRAPHICAL REPRESENTATION, SHALL STILL BE READ/WRITE ACCESSIBLE AT THE OWS/BAS. ALL SETPOINTS, TIMERS, DEADBANDS, SCHEDULES, ETC. LISTED HEREIN THE SEQUENCE SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR. VALUES FOR ALL POINTS, INCLUDING HARDWARE POINTS, SHALL BE OVERRIDABLE. EXCEPTIONS CAN BE MADE REGARDING MACHINE OR LIFE SAFETY.

EQUIPMENT MOTORS INTENDED TO BE MODULATED CAN BE PROVIDED WITH EITHER VARIABLE FREQUENCY DRIVES OR ELECTRONIC COMMUTATED MOTOR; SEQUENCE MAY USED INTERCHANGEABLE.

DISCHRAGE AIR TEMPERATURE SETPOINT SHALL BE 70°F (ADJ.) IN WINTER AND 75°F (ADJ.) IN SUMMER.

UNOCCUPIED CONTROL:

DURING UNOCCUPIED MODE, THE OUTDOOR AIR AND EXHAUST AIR DAMPER SHALL BE FULLY CLOSED. THE SUPPLY FAN SHALL BE OFF. THE TEMPERATURE CONTROL LOOP SHALL BE SET TO DEADBAND.

OUTDOOR AIR CONTROL:

OUTDOOR AIRFLOW RATE SHALL BE MEASURED BY AN AIRFLOW MEASURING DEVICE.

ECONOMIZER BYPASS DAMPERS (DRY-BULB):

DURING UNOCCUPIED MODE, THE BYPASS DAMPER(S) SHALL BE CLOSED.

WHILE IN OCCUPIED MODE, IF THE OUTDOOR AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE, THE UNIT SHALL MODULATE THE BYPASS DAMPER TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AND MINIMIZE THE TOTAL MECHANICAL COOLING. THE ECONOMIZER IS THE FIRST STAGE OF COOLING. THE WHEEL SHALL STOP.

IF THE OUTDOOR AIR TEMPERATURE EXCEEDS RETURN AIR TEMPERATURE OR IF THE OUTDOOR AIR TEMPERATURE EXCEEDS 75°F, THE BYPASS DAMPER SHALL CLOSE.

IF THE OUTDOOR AIR TEMPERATURE IS LOWER THAN 45°F, THE BYPASS DAMPER(S) SHALL CLOSE.

ENTHALPY WHEEL CONTROL:

DURING UNOCCUPIED MODE, THE ENTHALPY WHEEL SHALL BE STOPPED.

IN OCCUPIED MODE, IF THE OUTDOOR AIR ENTHALPY (CALCULATED) IS GREATER THAN THE RETURN AIR ENTHALPY (CALCULATED) OR IF THE OUTDOOR AIR TEMPERATURE EXCEEDS 75°F, THE UNIT SHALL MODULATE THE ENTHALPY WHEEL TO MAX SPEED. AT CONDITION, THE ENTHALPY WHEEL SHALL BE THE FIRST STAGE OF COOLING.

IN OCCUPIED MODE, WHENEVER THE OUTDOOR AIR TEMPERATURE IS LESS THAN THE DISCHARGE AIR TEMPERATURE, THE ENTHALPY WHEEL SHALL MODULATE SPEED TO MAINTAIN REQUIRED DISCHARGE TEMPERATURE. THE ENTHALPY WHEEL SHALL BE THE FIRST STAGE OF HEATING.

IF UNIT HAS PACKAGED CONTROLS, MANUFACTURER SEQUENCES SHALL GOVERN.

ENTHALPY WHEEL DEFROST CONTROL:

THE UNITS CONTROLLER SHALL PROVIDE MEANS TO PROTECT WHEEL FROM FROSTING. THE UNIT SHALL USE AN ELECTRIC PREHEAT COIL TO PRETREAT THE OUTDOOR AIR PRIOR TO ENTERING THE WHEEL WHENEVER FROST CONDITIONS ARE POSSIBLE. CONTROLS CONTRACTOR SHALL CONSULT MANUFACTURERS LITTERATURE.

FIRE ALARM MODE CONTROL:

THE SUPPLY FAN SHALL SHUT DOWN. WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL VIA THE FIRE ALARM CONTROL MODULE. NEXT, THE OUTDOOR AIR DAMPER SHALL CLOSE AND THE UNIT SHALL BE DISABLED.

SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

SUPPLY FAN AND SUPPLY AIR TEMPERATURE CONTROL:

THE SUPPLY FAN SHALL RUN WHEN THE SYSTEM IS OPERATING IN OCCUPIED MODE.

PRIOR TO START AND OPERATION OF THE SUPPLY FAN, THE OUTDOOR AIR DAMPER SHALL OPEN.

THE SUPPLY FAN SHALL BE AUTOMATICALLY STARTED AND STOPPED BY THE DOAS CONTROLLER OR BAS. THE SUPPLY FAN SHALL RUN AT CONSTANT VOLUME.

THE DOAS SHALL CONTROL TO DISCHARGE AIR TEMPERATURE.

WHEN THERE IS A CALL FOR MECHANICAL HEATING OR COOLING, THE HEAT PUMP CONTROL VALVE SHALL OPEN FULLY. THE UNIT SHALL THEN MODULATE THE HEAT PUMP SYSTEM, THE ENERGY RECOVERY WHEEL, AND/OR THE BYPASS DAMPERS TO MAINTAIN **DISCHARGE AIR TEMPERATURE** SETPOINT IN THE MOST ENERGY EFFICENT MANNER.

RELIEF FAN CONTROL:

PROVIDE OFFSET TO MAINTAIN BUILDING POSITIVE BUILDING PRESSURE (0.03 - 0.05 IN W.C.).

PRIOR TO START AND OPERATION OF THE EXHAUST FAN, THE OUTDOOR AIR DAMPER SHALL OPEN.

ENABLE, DISABLE, AND MODULATE EXHAUST FAN BASED ON BUILDING PRESSURE CONTROL.

DEHUMIDIFICATION CONTROL:

DEHUMIDICATION MODE SHALL BE ENABLED DURING NORMAL DOAS OPPERATION WHEN THE SUPPLY FAN IS PROVEN ON, THE RETURN AIR HUMIDITIY RAISES ABOVE 60% RH, AND THE OUTDOOR TEMPERATURE IS ABOVE 55°F.

WHEN ENABLED, THE DOAS CONTROLLER SHALL DISABLE THE ECONOMIZER. NEXT, THE HEAT PUMP COOLING SYSTEM SHALL MODULATE THE MECHANICAL COOLING SYSTEM TO OVERCOOL THE AIR, LOWERING THE MOISTURE CONTENT. THE MODULATING HOT GAS REHEAT SYSTEM SHALL BE USED TO MAINTIAN THE DISCHRAGE AIR TEMPERATURE SETPOINT. ONCE THE RETURN AIR HUMIDITY LOWERS TO 50% RH DEHUMIDIFICATION MODE SHALL BE DISABLED.

ALARMS AND SAFETIES

PROVIDE ALL RELEVANT ALARMS TO NOTIFY SYSTEM OPERATORS OF MAINTENANCE, PERFORMANCE, EQUIPMENT, OR LIFE-SAFETY ERRORS AND FAULTS. REFER TO MANUFACTURER INFORMATION, CODE REQUIREMENTS, AND ASHRAE 36 RECOMMENDATIONS FOR ADDITIONAL SAFETIES AND ALARMS.

HIGH STATIC PRESSURE SAFETY SWTICH: WHEN THE SAFETY SWITCH IS TRIPPED, DISABLE SUPPLY FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE. HIGH PRESSURE SHALL BE SET TO TRIP AT 4" W.G. AND SHALL BE RESET MANUALLY AT THE UNIT.

FREEZE STAT: WHEN A FREEZE CONDITION OCCURS, DISABLE SUPPLY FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE. FREEZE STAT SHALL BE SET TO TRIP AT 40°F AND SHALL BE RESET MANUALLY AT THE UNIT.

DUCT SMOKE DETECTOR: WHEN SMOKE IS DETECTED, DISABLE SUPPLY FAN AND RELIEF FAN (HARDWIRED) AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

FILTER DIFFERENTIAL SWTICH: WHEN DIFFERENTIAL PRESSURE ACCROSS THE FILTERS EXCEEDS ALLOWABLE LIMIT, GENERATE AN ALARM AT THE BAS.

FAN STATUS: THE BAS SHALL MONITOR FAN CURRENT SWITCHES. IF STATUS DOES NOT MATCH COMMAND OUTPUT, DISABLE FAN AND GENERATE AN ALARM AT THE BAS. ALL OTHER COMPONENTS SHALL RETURN TO AN UNOCCUPIED/OFF CONTROL MODE.

DAMPER POSITION: KNOWLEDGE OF DAMPER POSITION SHALL BE REQUIRED; A MODULATING (ANALOG) ACTUATOR OR FLOATING ACTUATOR CAN BE USED. IF DAMPER POSITION IS DETERMINED BY THE BAS TO BE INCORRECT, GENERATE AN ALARM AT THE BAS.

VALVE POSITION: KNOWLEDGE OF VALVE POSITION SHALL BE REQUIRED. IF VALVE POSITION IS DETERMINED BY THE BAS TO BE INCORRECT, GENERATE AN ALARM AT THE BAS.

OUTDOOR AIR DAMPER POSITION: THE OUTDOOR AIR DAMPER SHALL FAIL CLOSED. IF THE OUTDOOR AIR DAMPER FAILS TO OPEN/MODULATE, AS INDICATED BY THE END SWITCH, GENERATE AN ALARM AT THE BAS.

EXHAUST AIR DAMPER POSITION: THE RETURN AIR DAMPER SHALL FAIL OPEN. IF THE RETURN AIR DAMPER FAILS TO CLOSE/MODULATE, AS INDICATED BY THE END SWITCH, GENERATE AN ALARM AT THE BAS.

DISCHARGE AIR TEMPERATURE: IF DISCHARGE AIR TEMPERATURE FALLS OUT OF THE ALLOWABLE RANGE OF 5°F FOR A TIME PERIOD 10 MINUTES, GENERATE AN ALARM AT THE BAS.

DEDICATED OUTDOOR AIR UNIT W/ WSHP, ERW CONTROLS DIAGRAM

NO SCALE

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

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JOB NO. 2616.01A

SHEET TITLE
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SHEET NO.
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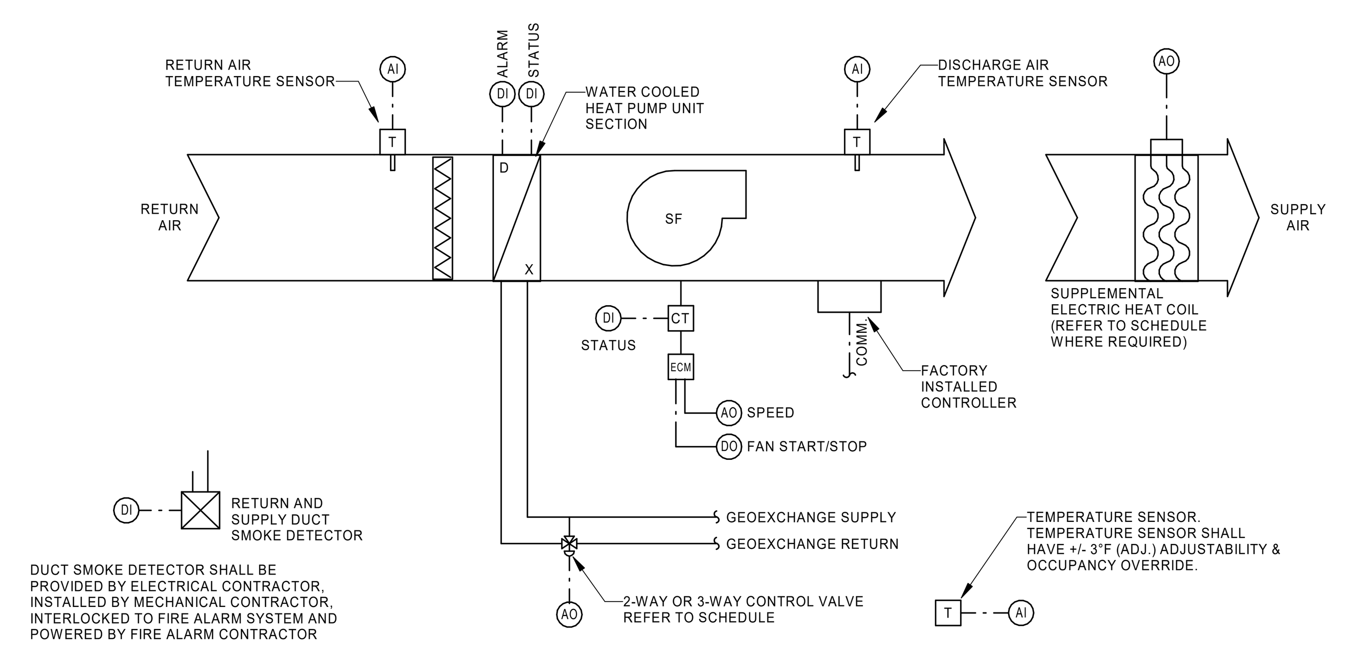


GENERAL

THE GROUND SOURCE HEAT PUMP (GSHP) UNIT SHALL BE ENABLED AND DISABLED DURING OCCUPIED AND UNOCCUPIED PERIODS BY THE BUILDING MANAGEMENT SYSTEM (BMS) ACCORDING TO THE MENU DRIVEN, HOURLY/WEEKLY SCHEDULING PROGRAM WHEN THE UNIT IS IN AUTO POSITION. THE UNIT SHALL BE KEPT IN AUTO POSITION. HAND AND OFF SHALL BE USED ONLY DURING MAINTENANCE.

DURING UNOCCUPIED MODE, THE BMS SHALL CONTINUOUSLY PULL SPACE TEMPERATURE SENSORS, IF SPACE TEMPERATURE/HUMIDITY FALLS OUTSIDE OF THE **UNOCCUPIED COOLING/HEATING SET-POINT** RANGE, THE UNIT SHALL BE ENABLED.

ALL SET-POINTS, TIME INTERVALS, AND OCCUPANCY SCHEDULES SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR AT THE OPERATOR'S WORKSTATION (OWS).

UNITS THAT ARE PROVIDED WITH PACKAGED OR SEMI PACKAGED CONTROLS SHALL BE CAPABLE OF INTERFACING / INTEGRATING INTO THE BMS.

SETPOINTS

VERIFY ALL SET-POINTS WITH OWNER.

ROOM SET-POINTS:

UNOCCUPIED COOLING SET-POINT SHALL BE 77ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND
UNOCCUPIED HEATING SET-POINT SHALL BE 65ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND
OCCUPIED COOLING SET-POINT SHALL BE 74ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND
OCCUPIED HEATING SET-POINT SHALL BE 70ºF (ADJ.) WITH ±1ºF (ADJ.) DEADBAND

MORNING WARMUP CONTROL

SIXTY MINUTES (ADJ.) PRIOR TO SCHEDULED OCCUPIED MODE, THE MORNING WARM-UP / COOL-DOWN ROUTINE SHALL BE INITIATED BY THE BMS.

UPON INITIATION, THE SUPPLY FAN SHALL BE ENERGIZED AND RUN AT MINIMUM AIRFLOW (AS DETERMINED BY UNIT MINIMUM TURNDOWN). SUPPLY FAN SHALL PROVE AIRFLOW TO THE BMS WITH ITS CURRENT SWITCH. IF NO CURRENT IS SENSED, DISABLE FAN AND GENERATE AN ALARM AT THE BMS. NOTE: THE ERV SHALL REMAIN OFF DURING FACILITY COOL-DOWN / WARM-UP OPERATION.

DURING MORNING WARM-UP, THE HEAT-PUMP SYSTEM AND THE SUPPLY FAN SHALL MODULATE AS REQUIRED (HEATING OR COOLING) TO MAINTAIN SPACE TEMPERATURE.

FAN AND TEMPERATURE CONTROL

WHEN THERE IS NO CALL FOR HEATING OR COOLING WITHIN THE SPACE, THE SUPPLY FAN SHALL RUN AT MINIMUM AIRFLOW (AS DETERMINED BY UNIT MINIMUM TURNDOWN).

AS SPACE TEMPERATURE RISES ABOVE COOLING / DROPS BELOW HEATING SET-POINTS, THE PACKAGED CONTROLLER SHALL MODULATE THE CONTROL VALVE TO MEET FLOW REQUIREMENTS FOR COMPRESSOR OPERATION. IF VALVE FAILS TO OPEN, DISABLE UNIT AND GENERATE ALARM AT THE BMS. THE PACKAGED CONTROLLER SHALL THEN MODULATE FAN SPEED, COMPRESSOR OPERATION, AND BACKUP/SUPPLEMENTAL ELECTRIC HEATING COIL TO MAINTAIN SPACE TEMPERATURE SET-POINT. SUPPLEMENTAL ELECTRIC HEATING COIL SHALL ONLY EVER BE ALLOWED TO ENERGIZE WHEN THERE IS A CALL FOR SPACE HEATING.

FIRE ALARM MODE CONTROL:
THE SUPPLY FAN SHALL SHUT DOWN WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL. SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

ADDITIONAL ALARMS AND SAFETIES:

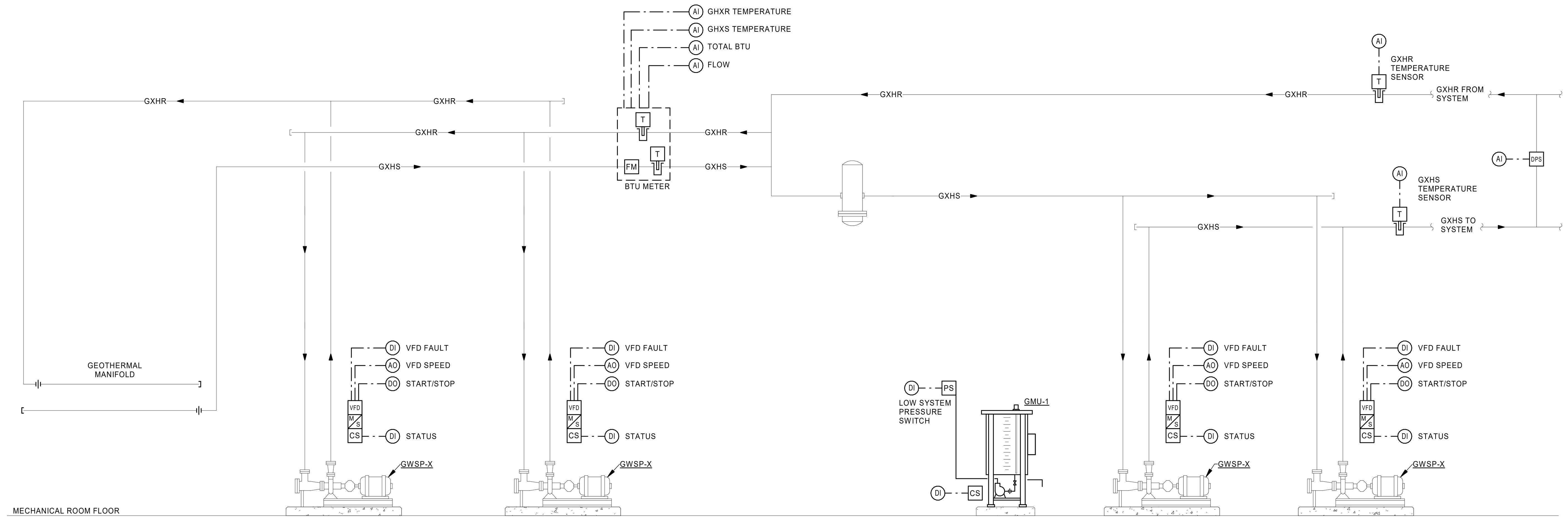
DUCT SMOKE DETECTORS SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR AND INSTALLED BY THE MECHANICAL CONTRACTORS IN THE RETURN AIR DUCTWORK FOR UNITS OVER 2000 CFM. DUCT SMOKE DETECTORS SHALL BE INTERLOCKED TO THE FIRE ALARM SYSTEM AND POWERED BY THE FIRE ALARM CONTRACTOR.

ALL STANDARD ALARMS AND SAFETIES FOR THE COMPRESSOR, CONTROL VALVE, AND FAN SHALL GENERATE AN ALARM AT THE BMS.

IF THE ROOM SENSOR IS BELOW OR EXCEEDS ALLOWABLE SET-POINTS FOR MORE THAN 30 MINS (ADJ.), GENERATE AN ALARM AT THE BMS.

WATER SOURCE HEAT PUMP CONTROL DIAGRAM

NO SCALE



GEOTHERMAL SYSTEM - PRIMARY/SECONDARY SEQUENCE OF OPERATIONS:
NOTE: ALL SETPOINTS AND TIME INTERVALS SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR.

THE GEOTHERMAL EXCHANGE SYSTEM SHALL BE ENABLED AND DISABLED DURING OCCUPIED AND UNOCCUPIED PERIODS BY THE BUILDING AUTOMATION SYSTEM (BAS). THE GEOTHERMAL EXCHANGE SYSTEM IS A PRIMARY/ SECONDARY SYSTEM CONSISTING OF: GEOTHERMAL FIELD/MANIFOLD, TWO GEOTHERMAL PRIMARY PUMPS THAT ARE EACH SIZED FOR 100% THE PEAK LOAD FLOW THAT WILL MODULATE VIA VFDS TO MAINTAIN LOOP TEMPERATURE, TWO GEOTHERMAL SECONDARY PUMPS THAT ARE EACH SIZED FOR 100% OF THE TOTAL DEMAND FLOW AND WILL MODULATE VIA VFDS TO MAINTAIN A SYSTEM DIFFERENTIAL PRESSURE SENSOR AND 2-WAY AND 3-WAY(DIVERTING) VALVES (REFER TO FLOOR PLANS/ SCHEDULES FOR LOCATION) AT EACH PIECE OF EQUIPMENT .

TEMPERATURE SENSORS INDICATED SHALL BE IMMERSION WELL TYPE WITH ADJUSTABLE TEMPERATURE DIFFERENTIAL.

TYPICAL PUMP OPERATION
WITH THE GEOTHERMAL SYSTEM PUMPS HAND/AUTO/OFF SWITCH IN THE "AUTO" POSITION, THE DDC SYSTEM SHALL ENERGIZE THE LEAD PUMP. ONE OF THE TWO PUMPS SHALL BE DESIGNATED "LEAD PUMP" AND SHALL OPERATE CONTINUOUSLY. THE OTHER PUMP SHALL SERVE AS THE STANDBY PUMP.

THE DDC SYSTEM SHALL ALTERNATE PUMP OPERATION BASED ON RUN TIME HOURS OR AT THE BEGINNING OF EACH MONTH.

EACH PUMP WILL PROVE OPERATION TO THE DDC SYSTEM WITH ITS CURRENT SWITCH. IF A PUMP FAILS, AN ALARM WILL BE SENT TO THE DDC SYSTEM AND THE STANDBY PUMP WILL BE ACTIVATED.

GEOTHERMAL FIELD (PRIMARY) LOOP OPERATION
THE PRIMARY PUMPS' SPEED SHALL MODULATE TO MAINTAIN TEMPERATURE SETPOINT OF THE SYSTEM . THE PUMPS SHALL OPERATE TO MAINTAIN A BUILDING (SECONDARY) LOOP TEMPERATURE BETWEEN 32°F-90°F.

WHEN THE RETURN WATER TEMPERATURE (AS SENSED BY GXHR TEMPERATURE SENSOR) REACHES 45°F (ADJ), THE LEAD PRIMARY LOOP PUMP SHALL BE STARTED AT MINIMUM SPEED (20% ADJ PER TAB CONTRACTOR). THE VFD SHALL MODULATE PUMP SPEED LINEARLY BETWEEN MINIMUM SPEED AT 45°F (ADJ) AND MAXIMUM SPEED (100% FLOW) AT 32°F.

WHEN THE RETURN WATER TEMPERATURE (AS SENSED BY GXHR TEMPERATURE SENSOR) REACHES 77°F (ADJ), THE LEAD PRIMARY LOOP PUMP SHALL BE STARTED AT MINIMUM SPEED (20% ADJ PER TAB CONTRACTOR). THE VFD SHALL MODULATE PUMP SPEED LINEARLY BETWEEN MINIMUM SPEED AT 77°F (ADJ) AND MAXIMUM SPEED (100% FLOW) AT 90°F.

WHEN FLOW IS REQUIRED, THE MINIMUM RUNTIME FOR THE PUMP SHALL BE 20 MINUTES (ADJ).

WHEN THE RETURN WATER TEMPERATURE (AS SENSED BY GXHR TEMPERATURE SENSOR) IS BETWEEN 45°F (ADJ) AND 77°F (ADJ), THE PRIMARY LOOP PUMPS SHALL BE DISABLED.

BUILDING (SECONDARY) LOOP OPERATION
SECONDARY PUMPS SPEED SHALL MODULATE TO MAINTAIN THE GEOTHERMAL SYSTEM WATER DIFFERENTIAL PRESSURE SETPOINT AS SET BY THE TEST & BALANCE CONTRACTOR.

GLYCOL MAKEUP
THE PACKAGED GLYCOL MAKEUP UNIT SHALL BE MONITORED BY THE BMS. IF A LOW LIMIT ALARM INITIATED BY THE UNIT, THE UNIT SHALL GENERATE AN ALARM AT THE BMS AND DE-ENERGIZE THE ASSOCIATED PUMPS. PROVIDE A CURRENT SWITCH ON THE GLYCOL PUMP TO VERIFY STATUS. IF COMMANDED ON, AND STATUS DOES NOT MATCH, GENERATE AN ALARM AT THE BMS

BTU METER
THE BTU METER SHALL MEASURE TOTAL FLOW, RETURN WATER TEMPERATURE, SUPPLY WATER TEMPERATURE, AND BTU TO THE BUILDING BMS. CONTROLS CONTRACTOR SHALL WORK WITH OWNER AND IT SERVICES TO DISPLAY OPERATION ON DASHBOARD.

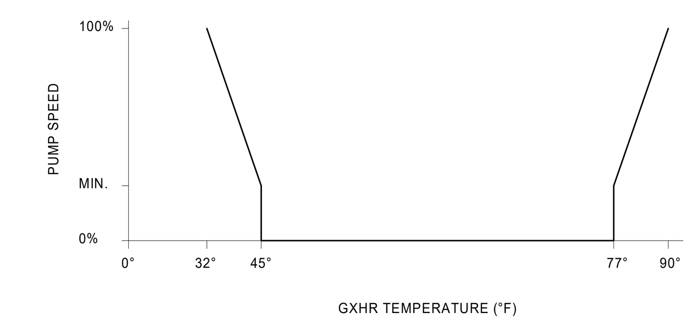
MONITORING AND ALARMS
THE BUILDING DDC SYSTEM SHALL MONITOR ALL TEMPERATURE POINTS, PUMP STATUS, PUMP ALARM, PUMP SPEED, DIFFERENTIAL PRESSURE SETPOINT, GLYCOL MAKEUP UNIT ALARMS.

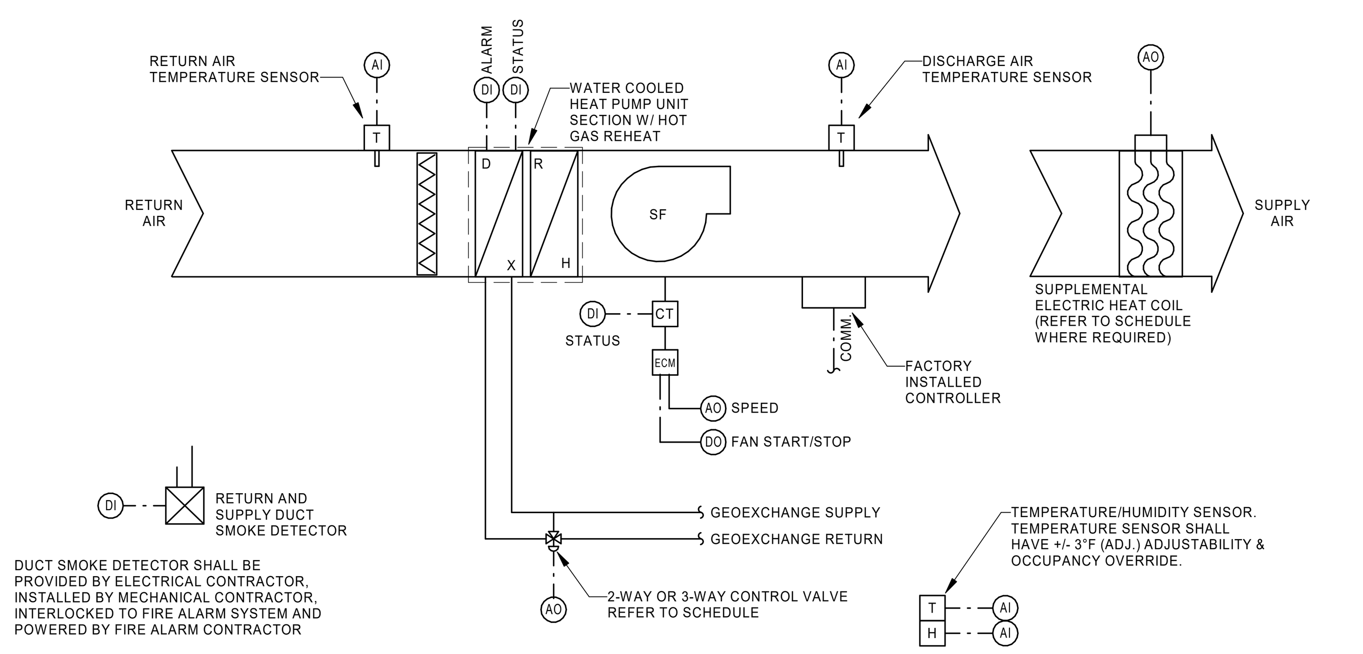
THE BUILDING DDC SYSTEM SHALL TREND ALL TEMPERATURE POINTS, PUMP SPEED, AND DIFFERENTIAL PRESSURE SET POINT.

GEOTHERMAL SYSTEM CONTROLS DIAGRAM

NO SCALE

GEOTHERMAL FIELD (PRIMARY) LOOP PUMP OPERATION





GENERAL

THE GROUND SOURCE HEAT PUMP (GSHP) UNIT SHALL BE ENABLED AND DISABLED DURING OCCUPIED AND UNOCCUPIED PERIODS BY THE BUILDING MANAGEMENT SYSTEM (BMS) ACCORDING TO THE MENU DRIVEN, HOURLY/WEEKLY SCHEDULING PROGRAM WHEN THE UNIT IS IN AUTO POSITION. THE UNIT SHALL BE KEPT IN AUTO POSITION. HAND AND OFF SHALL BE USED ONLY DURING MAINTENANCE.

DURING UNOCCUPIED MODE, THE BMS SHALL CONTINUOUSLY PULL SPACE TEMPERATURE SENSORS, IF SPACE TEMPERATURE/HUMIDITY FALLS OUTSIDE OF THE **UNOCCUPIED COOLING/HEATING SET-POINT** RANGE, THE UNIT SHALL BE ENABLED.

ALL SET-POINTS, TIME INTERVALS, AND OCCUPANCY SCHEDULES SHALL BE ADJUSTABLE BY THE SYSTEM OPERATOR AT THE OPERATOR'S WORKSTATION (OWS).

UNITS THAT ARE PROVIDED WITH PACKAGED OR SEMI PACKAGED CONTROLS SHALL BE CAPABLE OF INTERFACING / INTEGRATING INTO THE BMS.

SETPOINTS

VERIFY ALL SET-POINTS WITH OWNER.

ROOM SET-POINTS:

UNOCCUPIED COOLING SET-POINT SHALL BE 77ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND AND 55% RH (ADJ.) WITH A +5% (ADJ) DEADBAND
UNOCCUPIED HEATING SET-POINT SHALL BE 65ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND
OCCUPIED COOLING SET-POINT SHALL BE 74ºF (ADJ.) WITH A ±1ºF (ADJ.) DEADBAND AND 50% RH (ADJ.) WITH A +5% (ADJ) DEADBAND
OCCUPIED HEATING SET-POINT SHALL BE 70ºF (ADJ.) WITH ±1ºF (ADJ.) DEADBAND

MORNING WARMUP CONTROL

SIXTY MINUTES (ADJ.) PRIOR TO SCHEDULED OCCUPIED MODE, THE MORNING WARM-UP / COOL-DOWN ROUTINE SHALL BE INITIATED BY THE BMS.

UPON INITIATION, THE SUPPLY FAN SHALL BE ENERGIZED AND RUN AT MINIMUM AIRFLOW (AS DETERMINED BY UNIT MINIMUM TURNDOWN). SUPPLY FAN SHALL PROVE AIRFLOW TO THE BMS WITH ITS CURRENT SWITCH. IF NO CURRENT IS SENSED, DISABLE FAN AND GENERATE AN ALARM AT THE BMS. NOTE: THE ERV SHALL REMAIN OFF DURING FACILITY COOL-DOWN / WARM-UP OPERATION.

DURING MORNING WARM-UP, THE HEAT-PUMP SYSTEM AND THE SUPPLY FAN SHALL MODULATE AS REQUIRED (HEATING OR COOLING) TO MAINTAIN SPACE TEMPERATURE AND HUMIDITY SETPOINTS.

FAN AND TEMPERATURE CONTROL

WHEN THERE IS NO CALL FOR HEATING OR COOLING WITHIN THE SPACE, THE SUPPLY FAN SHALL RUN AT MINIMUM AIRFLOW (AS DETERMINED BY UNIT MINIMUM TURNDOWN).

AS SPACE TEMPERATURE RISES ABOVE COOLING / DROPS BELOW HEATING SET-POINTS, THE PACKAGED CONTROLLER SHALL MODULATE THE CONTROL VALVE TO MEET FLOW REQUIREMENTS FOR COMPRESSOR OPERATION. IF VALVE FAILS TO OPEN, DISABLE UNIT AND GENERATE ALARM AT THE BMS. THE PACKAGED CONTROLLER SHALL THEN MODULATE FAN SPEED, COMPRESSOR OPERATION, AND SUPPLEMENTAL HEATING COIL TO MAINTAIN SPACE TEMPERATURE AND HUMIDITY SETPOINTS. SUPPLEMENTAL ELECTRIC HEATING COIL SHALL ONLY EVER BE ALLOWED TO ENERGIZE WHEN THERE IS A CALL FOR SPACE HEATING.

FIRE ALARM MODE CONTROL:
THE SUPPLY FAN SHALL SHUT DOWN WHEN ANY AUTOMATIC OR MANUAL FIRE ALARM DEVICE IS PLACED INTO ALARM BY THE BUILDING FIRE ALARM CONTROL PANEL. SYSTEM SHALL MANUALLY RESET FOLLOWING AN ALARM EVENT.

ADDITIONAL ALARMS AND SAFETIES:

DUCT SMOKE DETECTORS SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR AND INSTALLED BY THE MECHANICAL CONTRACTORS IN THE RETURN AIR DUCTWORK FOR UNITS OVER 2000 CFM. DUCT SMOKE DETECTORS SHALL BE INTERLOCKED TO THE FIRE ALARM SYSTEM AND POWERED BY THE FIRE ALARM CONTRACTOR.

ALL STANDARD ALARMS AND SAFETIES FOR THE COMPRESSOR, CONTROL VALVE, AND FAN SHALL GENERATE AN ALARM AT THE BMS.

IF THE ROOM SENSOR IS BELOW OR EXCEEDS ALLOWABLE SET-POINTS FOR MORE THAN 30 MINS (ADJ.), GENERATE AN ALARM AT THE BMS.

WATER SOURCE HEAT PUMP W/ HGRH CONTROL DIAGRAM

NO SCALE

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
CONTROL DIAGRAMS

SHEET NO.
M8.4

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HVAC KEYNOTES

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H3 GRILLES MOUNTED AT 22". REFER TO DETAIL.

H4 GRILLES MOUNTED AT 45°. REFER TO DETAIL.

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H7 CONNECT DISHWASHER EXHAUST DUCTWORK TO COLLAR ON DISHWASHER (BY FSEC), PROVIDE 18 GA. STAINLESS STEEL WELDED DUCTWORK. PROVIDE STAINLESS STEEL TRIM COLLAR AT CEILING.

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H9 90X24" RA ELBOW DOWN ALONG WALL. FINISH WITH BELLMOUTH OPENING AND BIRD SCREEN APPROX 15'-0" A.F.F.

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H12 PROVIDE GALVANEALED DUCTWORK AND PAINT TO MATCH ARCHITECTURAL FINISH. COORDINATE COLOR WITH ARCHITECTURE.

H13 4" DRYER EXHAUST. PROVIDE DRYER TERMINATION CAP IN SIDE WALL OF ROOF CURB. TERMINATE IN ROOF CURB SIMILAR TO PIPE CURB DETAIL, REFER TO DETAIL SHEETS. FOLLOW ALL MANUFACTURER GUIDELINES FOR EXHAUST ROUTING AND TERMINATION.

H14 8ms controller. Coordinate location with controls contractor and electrical contractor. Controls programming by mechanical contractor.

H15 ROUTE DUCTWORK WITHIN TRUSS SPACE. COORDINATE WITH STRUCTURAL TRADES.

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HVAC GENERAL NOTES

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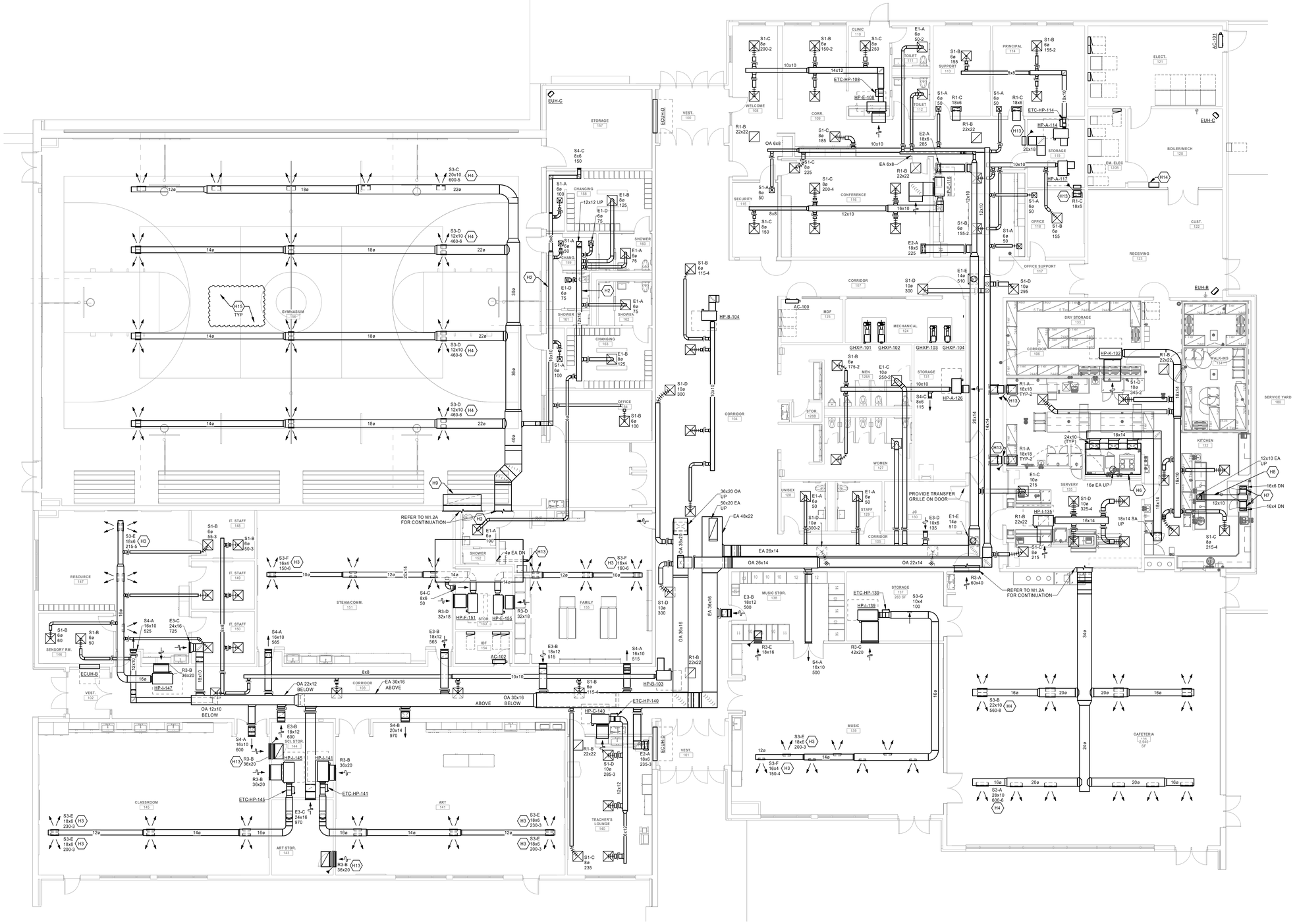

MECHANICAL HVAC PLAN - UNIT 100A

SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

100A | 100B | 200 | 300 | 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
MECHANICAL HVAC PLAN - UNIT 100A

SHEET NO.
MH1.1A

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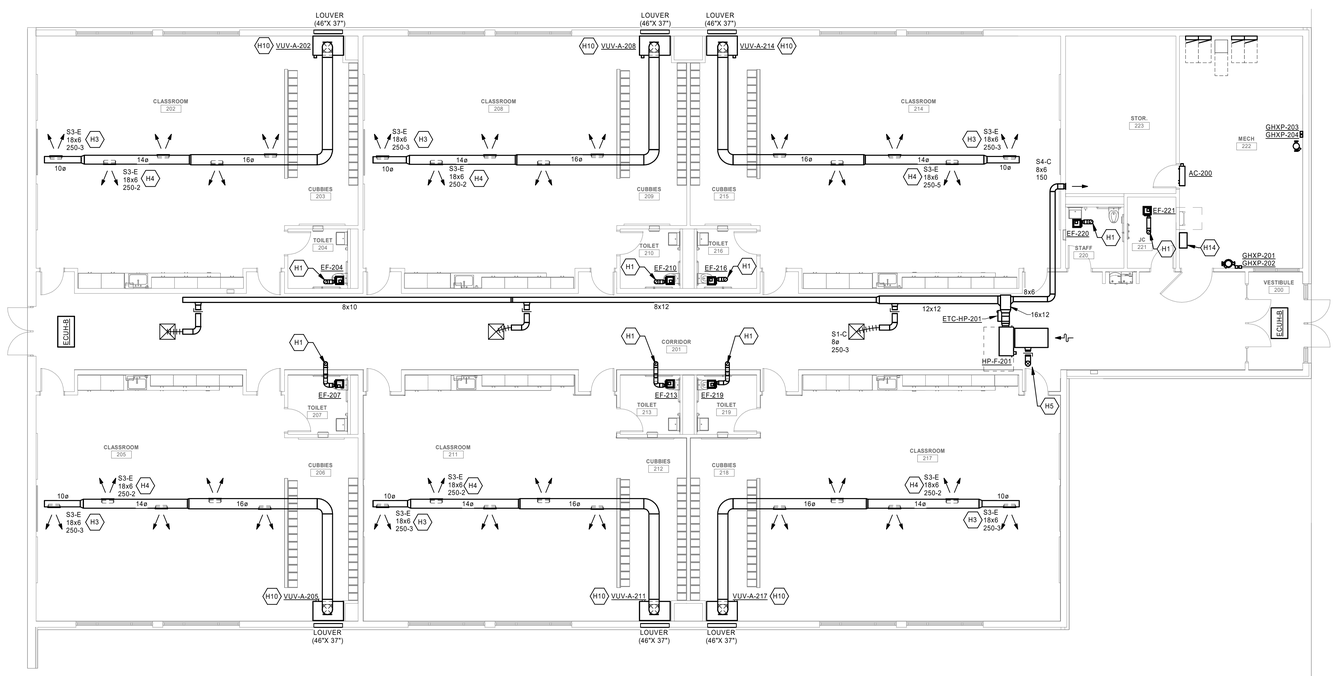

MECHANICAL HVAC PLAN - UNIT 200

SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN R. GUNTHER, JR.
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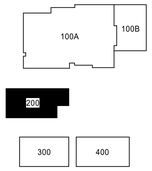
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL HVAC PLAN - UNIT 200

SHEET NO.

MH1.2

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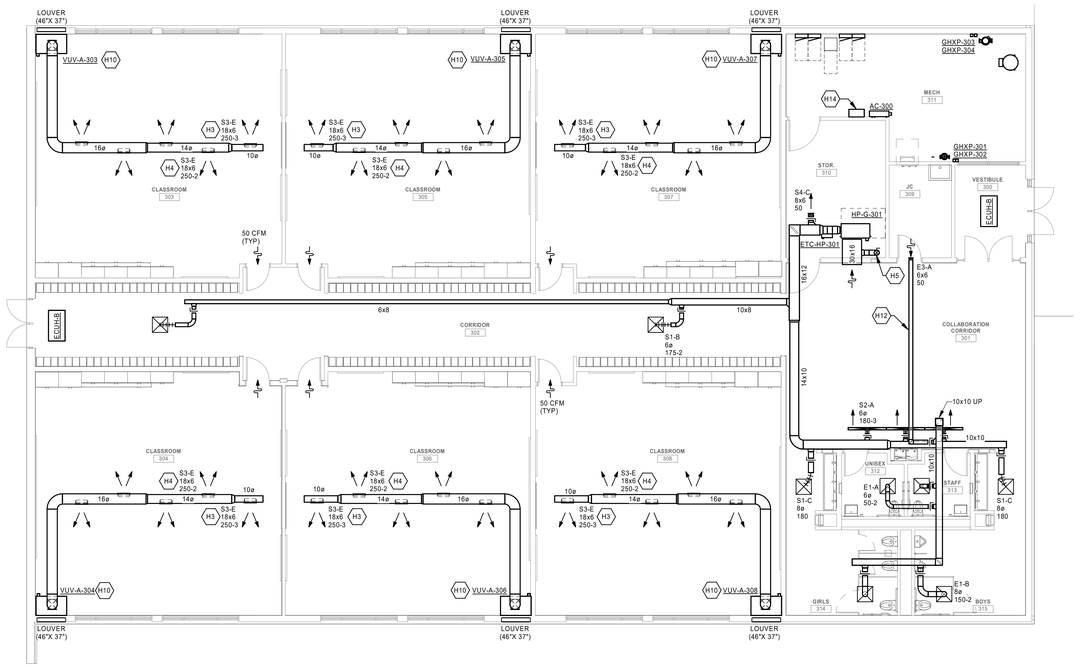

MECHANICAL HVAC PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

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01/26/2024

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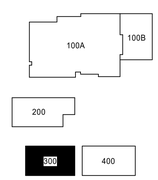

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
MECHANICAL HVAC PLAN - UNIT 300

SHEET NO.
MH1.3

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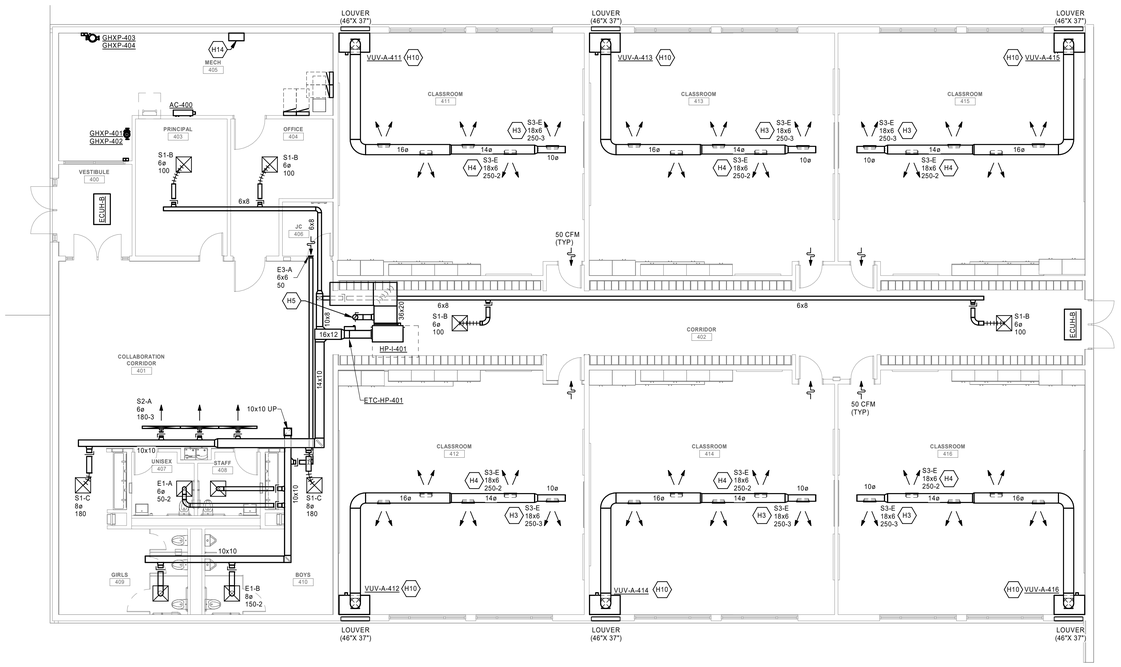

MECHANICAL HVAC PLAN - UNIT 400

SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN R. GUNTHER, JR.
ENGINEER
No. 0201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
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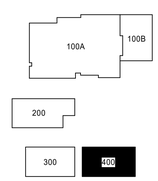

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL HVAC PLAN - UNIT 400

SHEET NO.

MH1.4

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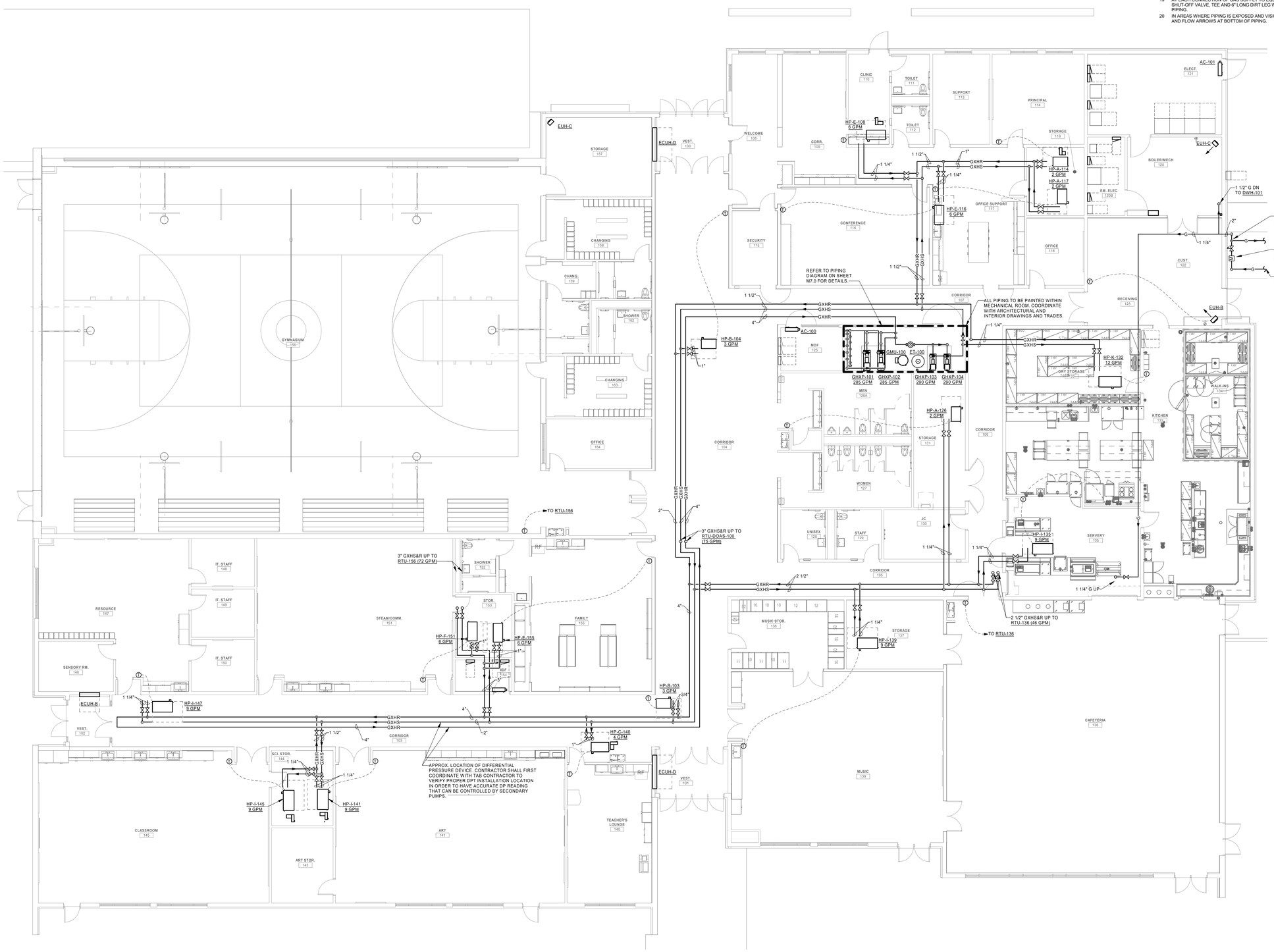

MECHANICAL PIPING PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

KINGSCOTT
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100A 100B 200 300 400

KEY PLAN

ISD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
MECHANICAL PIPING PLAN - UNIT 100A

SHEET NO.
MP1.1A

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9. BRANCH DUCTWORK TO GRILLES, REGISTERS AND DIFFUSERS SHALL BE THE SAME SIZE AS THE GRILLE, REGISTER OR DIFFUSER NECK SIZE WHERE NO DUCT SIZE IS INDICATED ON PLAN.
10. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL BE 5'-0".
11. FOR EQUIPMENT VALVING, COMPONENT, AND PIPING ARRANGEMENT, REFER TO PIPING DIAGRAMS AND DETAILS.
12. PAINT ALL VISIBLE INTERIOR SURFACES OF EXHAUST/RETURN GRILLES, REGISTERS AND VISIBLE ASSOCIATED DUCTWORK FLAT BLACK.
13. THE CEILING SPACE IS USED AS A RETURN AIR PLENUM. NO PLASTIC MATERIALS INCLUDING PVC PIPING, CONDUIT, WIRING, ETC. SHALL BE USED. ALL MATERIAL IN THE CEILING SPACE IS TO BE PLENUM RATED.
14. PROVIDE CODE REQUIRED CLEARANCE/ACCESS DOORS FOR DAMPERS, VALVES, AND CLEANOUTS LOCATED IN WALLS OR ABOVE HARD CEILINGS. COORDINATE LOCATIONS WITH ARCHITECT. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPES.
15. DUCTWORK TO AND FROM VAV BOXES/TERMINAL UNITS SHALL BE EQUAL TO THE BOX CONNECTIONS SIZES UNLESS INDICATED OTHERWISE.
16. CONNECTION TO EQUIPMENT SHALL BE VERIFIED WITH MANUFACTURER'S CERTIFIED DRAWINGS. TRANSITIONS TO ALL EQUIPMENT SHALL BE VERIFIED AND PROVIDED FOR EQUIPMENT FURNISHED.
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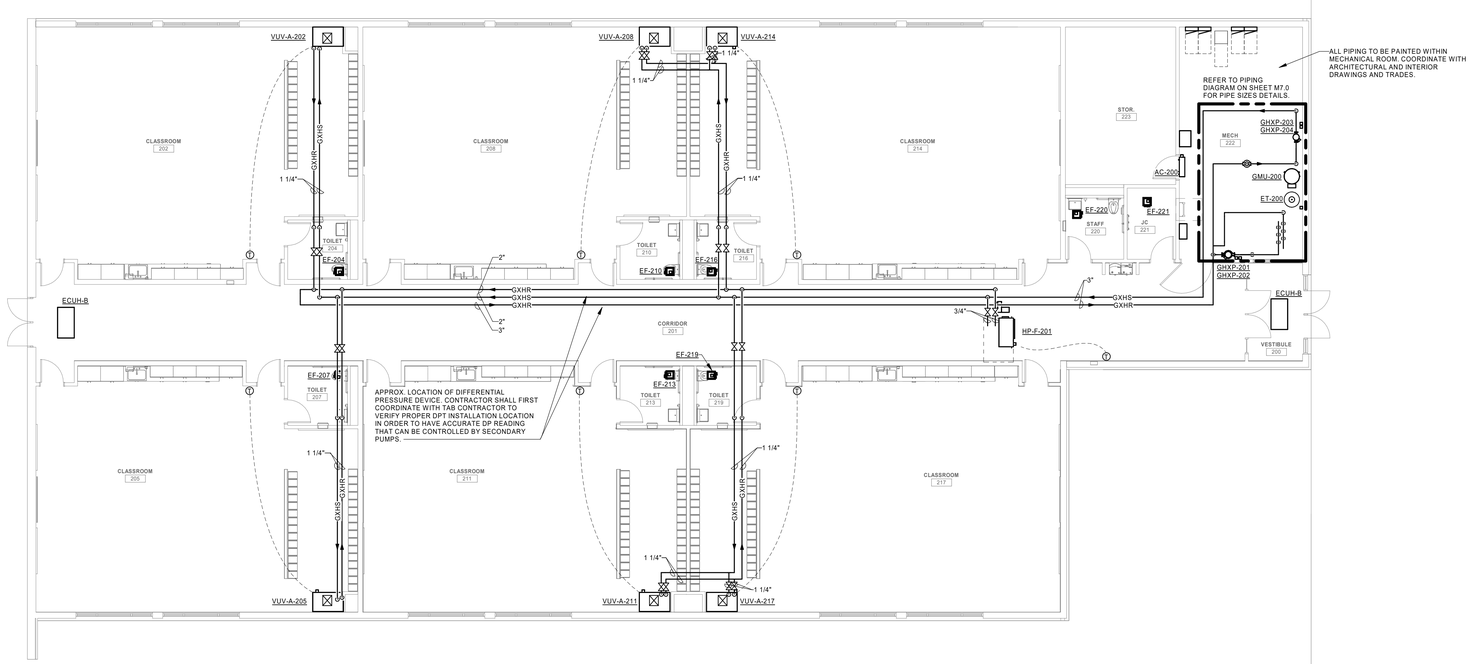
20 IN AREAS WHERE PIPING IS EXPOSED AND VISIBLE TO OCCUPANTS, PLACE PIPING LABEL AND FLOW ARROWS AT BOTTOM OF PIPING.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



MECHANICAL PIPING PLAN - UNIT 200

SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL PIPING PLAN - UNIT 200

SHEET NO.

MP1.2

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HVAC GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE HVAC SYSTEMS COMPLETE PER SPECIFICATION, SMACNA STANDARDS, AND PER APPLICABLE CODES INCLUDING ALL NECESSARY OFFSETS, FITTINGS, SPECIAL RADIUS OR MITERED ELBOWS WHICH ARE REQUIRED DUE TO SPACE CONSTRAINTS OR STRUCTURAL CONDITIONS OR OTHER CONDITIONS.
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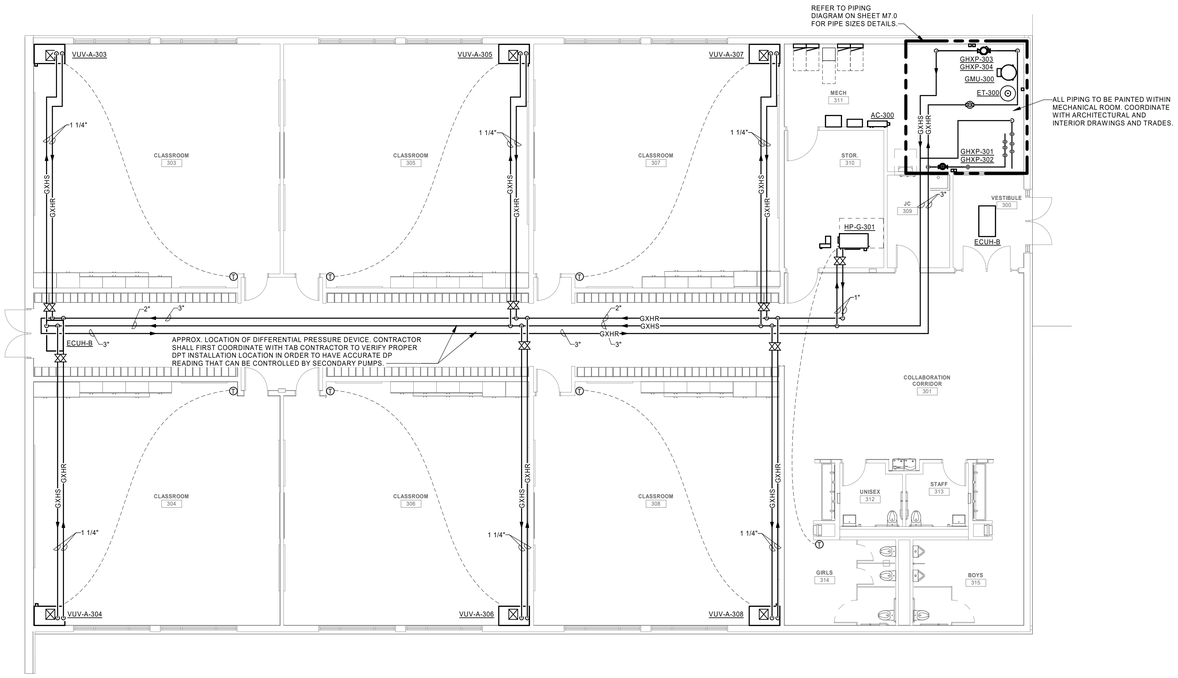
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



MECHANICAL PIPING PLAN - UNIT 300

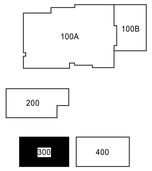
SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 0201067419
LICENSED PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL PIPING PLAN - UNIT 300

SHEET NO.

MP1.3

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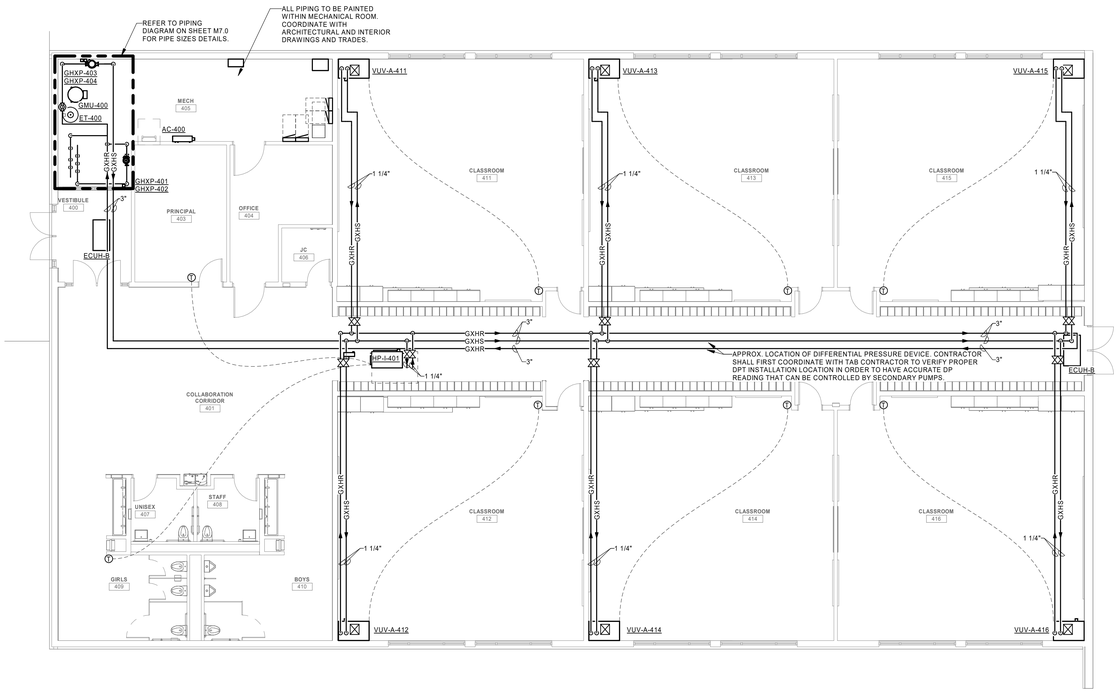
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



MECHANICAL PIPING PLAN - UNIT 400

SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A | 100B | 200 | 300 | 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

MECHANICAL PIPING PLAN - UNIT 400

SHEET NO.

MP1.4

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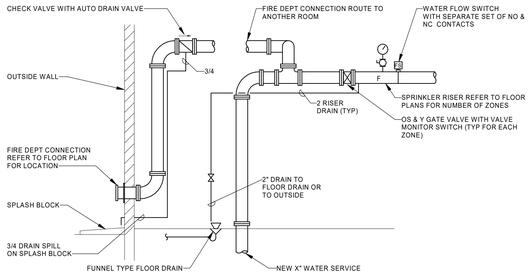
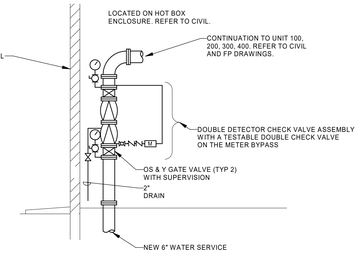
FIRE PROTECTION HYDRAULIC DESIGN CRITERIA

OCCUPANCY	HAZARD CLASSIFICATION	REMOTE AREA (SQUARE FEET)	DENSITY (GPM PER SQ. FT.)	REMARKS
CLASSROOMS, PUBLIC SPACES, LOBBIES, CORRIDORS, OFFICES, LOUNGES, MEETING ROOMS, GUEST ROOMS, ETC.., CEILING SPACES WITH COMBUSTIBLE MATERIALS.	LIGHT HAZARD	1500 (OR 5 HEADS MINIMUM)	0.10	USE QUICK RESPONSE SPRINKLERS
MECHANICAL ROOMS, ELECTRICAL ROOMS, EQUIPMENT ROOMS, KITCHENS, FOOD SERVICE AREAS, MAINTENANCE ROOMS, STORAGE ROOMS	ORDINARY HAZARD GROUP 1	1500 (OR 5 HEADS MINIMUM)	0.15	USE QUICK RESPONSE SPRINKLERS

NOTES:
1. DESIGN AND DESIGN CRITERIA SHALL BE PER NFPA.
2. MAXIMUM AREA PER HEAD CAN BE 400 SF, WHERE EXTENDED COVERAGE HEADS ARE ALLOWED AND UTILIZED.



VERTICAL AUTOMATIC SPRINKLER RISER DIAGRAM
NO SCALE



VERTICAL DOUBLE DETECTOR CHECK SPRINKLER RISER DIAGRAM
NO SCALE

FIRE PROTECTION GENERAL NOTES

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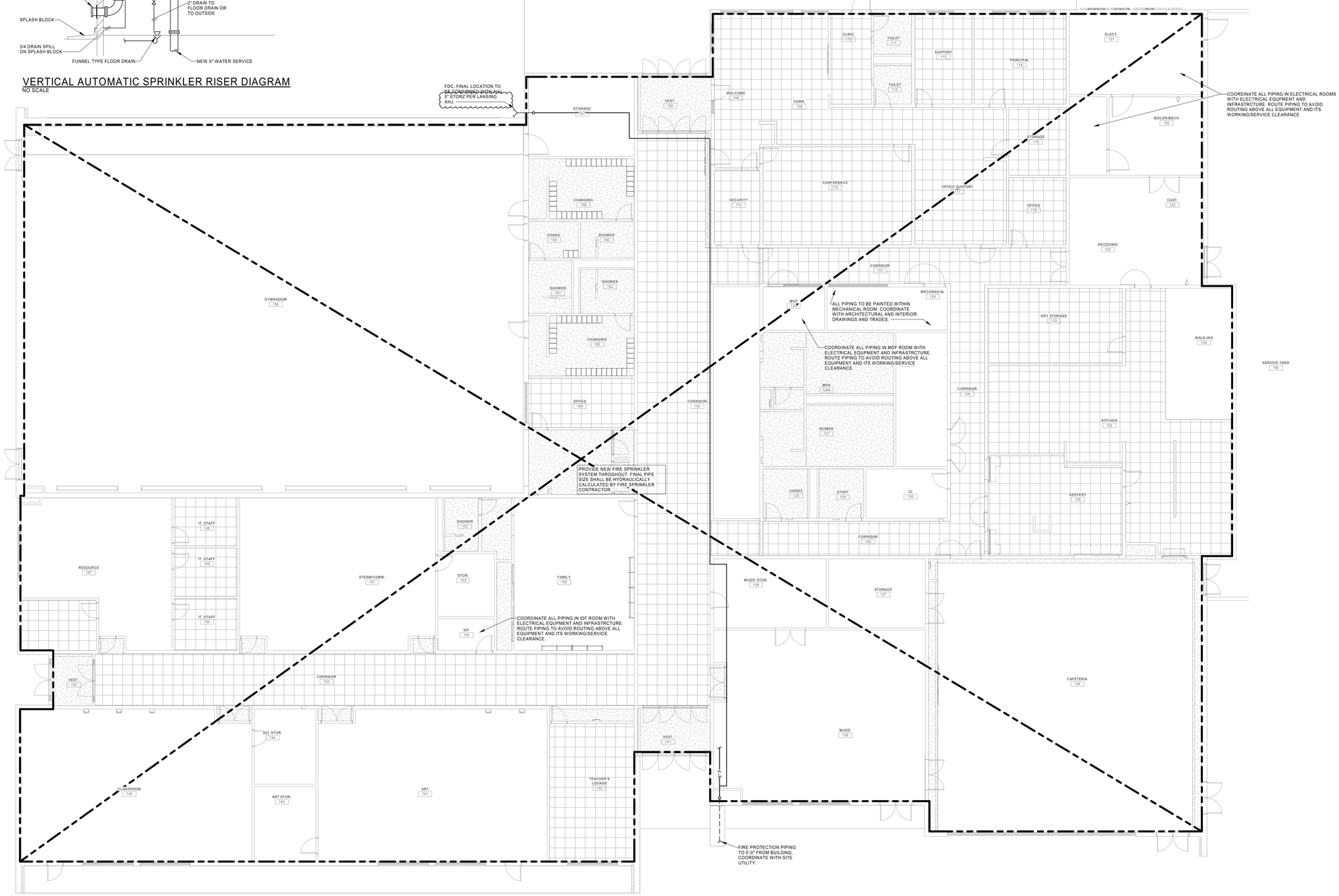
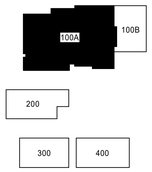


FIRE PROTECTION PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN

ISD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
FIRE PROTECTION PLAN - UNIT 100A

SHEET NO.
FP1.1A

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FIRE PROTECTION GENERAL NOTES

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KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

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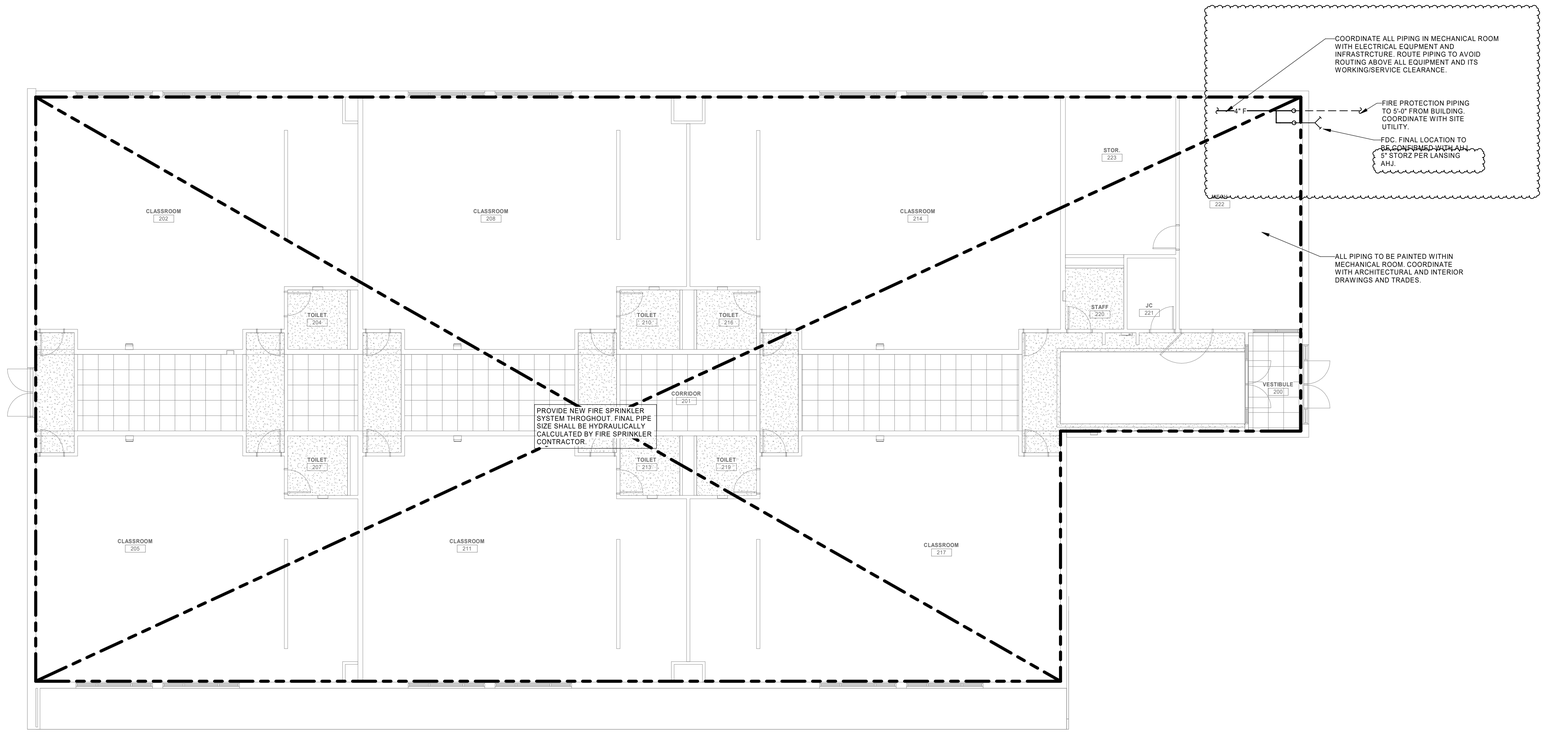
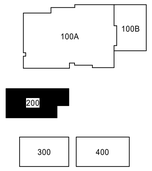


FIRE PROTECTION PLAN - UNIT 200
SCALE: 1/8" = 1'-0"

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

FIRE PROTECTION PLAN - UNIT 200

SHEET NO.

FP1.2

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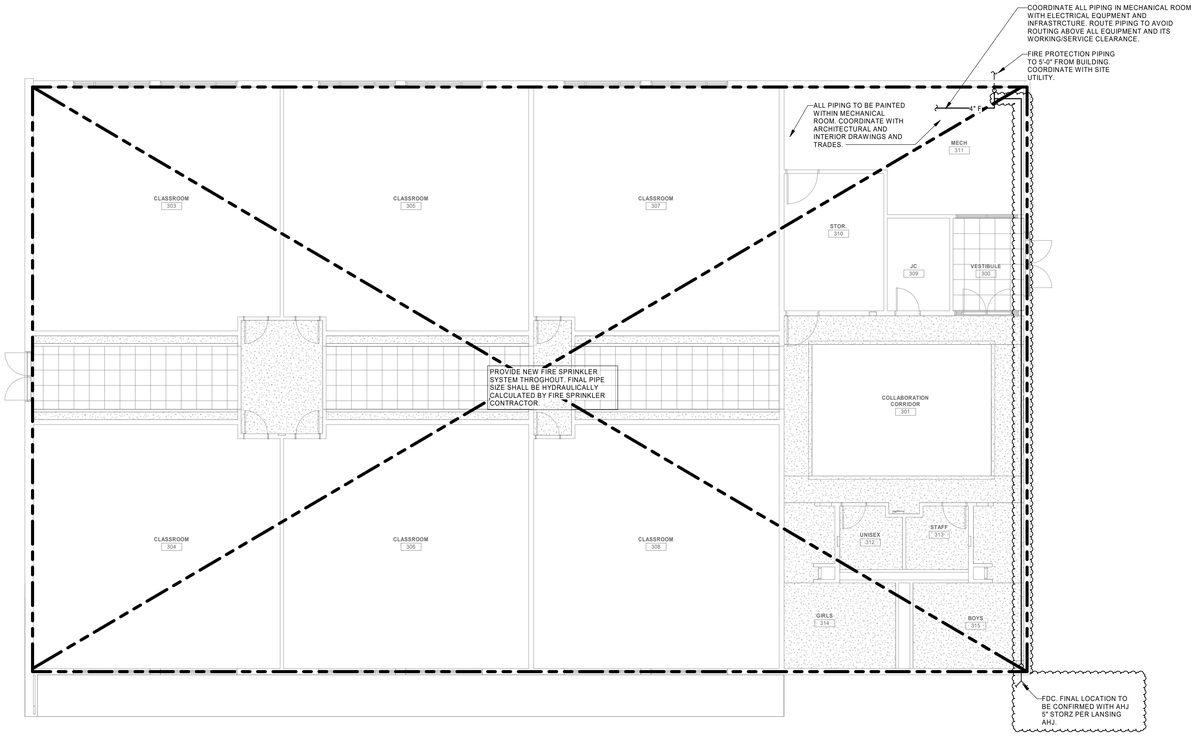
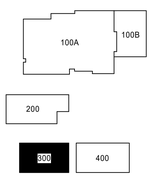


FIRE PROTECTION PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

FIRE PROTECTION PLAN - UNIT 300

SHEET NO.

FP1.3

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FIRE PROTECTION GENERAL NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL INTENT OF THE WORK. PROVIDE/REWORK FIRE PROTECTION SYSTEMS COMPLETE, PER APPLICABLE CODES, NFPA, OWNERS INSURER'S REQUIREMENTS AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION INCLUDING ALL PIPING, OFFSETS, FITTINGS, DRAINS, VALVES, SPRINKLER HEADS, ETC. AS REQUIRED FOR A COMPLETE OPERABLE SYSTEM.
2. CONTRACTOR SHALL COORDINATE HIS WORK WITH THE WORK OF ALL OTHER TRADES. SPRINKLER PIPING SHALL NOT BE LOCATED BELOW MECHANICAL EQUIPMENT.
3. MINIMUM RUN-OUT PIPE SIZE TO SPRINKLER HEADS SHALL BE 1".
4. FIRE PROTECTION TRADES SHALL SUBMIT PLANS, FLOW AND PRESSURE TEST AND CALCULATIONS TO THE LOCAL FIRE MARSHAL AND TO THE BUILDING'S INSURING AGENCY FOR APPROVAL. CONTRACTOR SHALL THEN MAKE ALL NECESSARY CORRECTIONS AND RESUBMIT PLANS AND CALCULATIONS FOR RECORD TO THE ARCHITECT AS WELL AS THE FIRE MARSHAL.
5. CONTRACTOR SHALL PROVIDE ALL NECESSARY TESTS AND PAY FOR ALL FEES, PERMITS, INSPECTIONS, AND LICENSES, AS REQUIRED BY THE LOCAL AUTHORITY.

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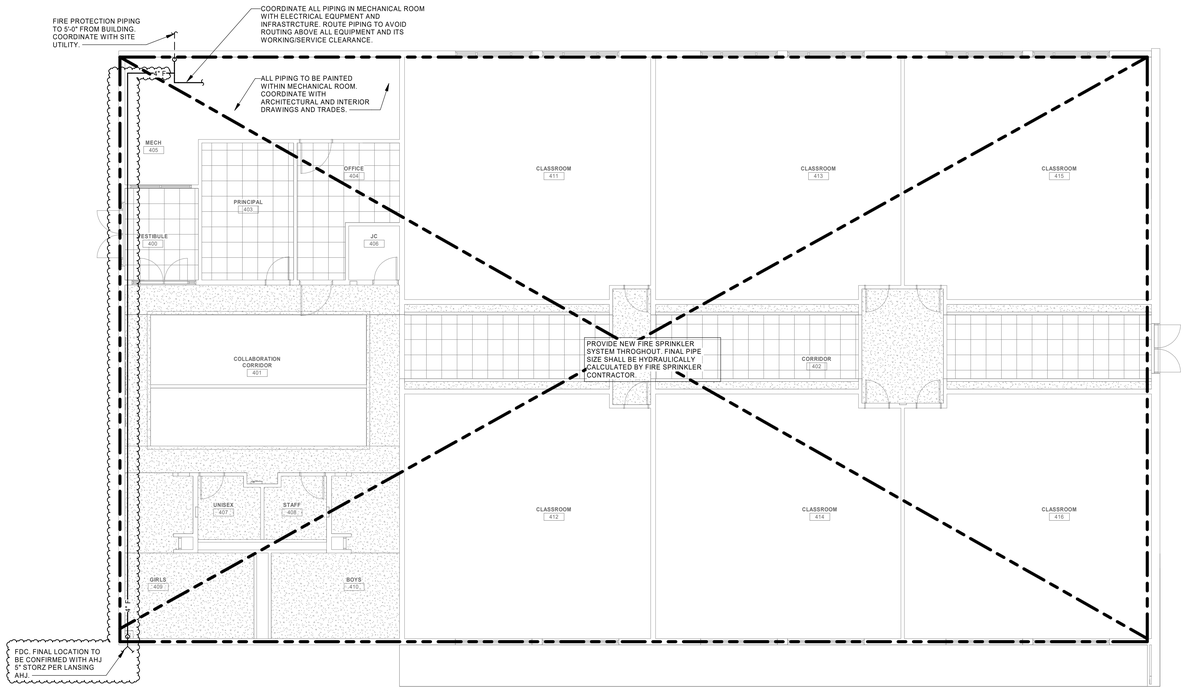
Willow School

Lansing School District

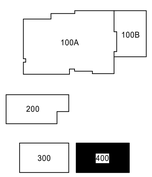
1012 W. Willow
Lansing, MI 48915



FIRE PROTECTION PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

FIRE PROTECTION PLAN - UNIT 400

SHEET NO.

FP1.4

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COPPER FEEDER SCHEDULE

FEEDER (AMPS)	COND. SIZE	2 WIRE WITH GROUND	FEEDER (AMPS)	COND. SIZE	3 WIRE WITH GROUND	FEEDER (AMPS)	COND. SIZE	4 WIRE WITH GROUND
15S	12	2#12, 1#12 GND IN 3/4"C	15	12	3#12, 1#12 GND IN 3/4"C	15N	12	4#12, 1#12 GND IN 3/4"C
20S	12	2#12, 1#12 GND IN 3/4"C	20	12	3#12, 1#12 GND IN 3/4"C	20N	12	4#12, 1#12 GND IN 3/4"C
25S	10	2#10, 1#10 GND IN 3/4"C	25	10	3#10, 1#10 GND IN 3/4"C	25N	10	4#10, 1#10 GND IN 3/4"C
30S	10	2#10, 1#10 GND IN 3/4"C	30	10	3#10, 1#10 GND IN 3/4"C	30N	10	4#10, 1#10 GND IN 3/4"C
35S	8	2#8, 1#10 GND IN 3/4"C	35	8	3#8, 1#10 GND IN 3/4"C	35N	8	4#8, 1#10 GND IN 3/4"C
40S	8	2#8, 1#10 GND IN 3/4"C	40	8	3#8, 1#10 GND IN 3/4"C	40N	8	4#8, 1#10 GND IN 3/4"C
45S	6	2#6, 1#10 GND IN 3/4"C	45	6	3#6, 1#10 GND IN 3/4"C	45N	6	4#6, 1#10 GND IN 1"C
50S	6	2#6, 1#10 GND IN 3/4"C	50	6	3#6, 1#10 GND IN 3/4"C	50N	6	4#6, 1#10 GND IN 1"C
60S	4	2#4, 1#10 GND IN 1"C	60	4	3#4, 1#10 GND IN 1"C	60N	4	4#4, 1#10 GND IN 1 1/4"C
70S	4	2#4, 1#8 GND IN 1"C	70	4	3#4, 1#8 GND IN 1"C	70N	4	4#4, 1#8 GND IN 1 1/4"C
80S	3	2#3, 1#8 GND IN 1"C	80	3	3#3, 1#8 GND IN 1"C	80N	3	4#3, 1#8 GND IN 1 1/4"C
90S	2	2#2, 1#8 GND IN 1"C	90	2	3#2, 1#8 GND IN 1 1/4"C	90N	2	4#2, 1#8 GND IN 1 1/2"C
100S	1	2#1, 1#8 GND IN 1 1/4"C	100	1	3#1, 1#8 GND IN 1 1/4"C	100N	1	4#1, 1#8 GND IN 1 1/2"C
			110	2	3#2, 1#6 GND IN 1 1/4"C	110N	2	4#2, 1#6 GND IN 1 1/4"C
			125	1	3#1, 1#6 GND IN 1 1/4"C	125N	1	4#1, 1#6 GND IN 1 1/2"C
			150	1/0	3#1/0, 1#6 GND IN 1 1/2"C	150N	1/0	4#1/0, 1#6 GND IN 2"C
			175	2/0	3#2/0, 1#6 GND IN 1 1/2"C	175N	2/0	4#2/0, 1#6 GND IN 2"C
			200	3/0	3#3/0, 1#6 GND IN 2"C	200N	3/0	4#3/0, 1#6 GND IN 2"C
			225	4/0	3#4/0, 1#4 GND IN 2"C	225N	4/0	4#4/0, 1#4 GND IN 2 1/2"C
			250	250	3-250 KCMIL, 1#4 GND IN 2"C	250N	250	4-250 KCMIL, 1#4 GND IN 2 1/2"C
			300	350	3-350 KCMIL, 1#4 GND IN 2 1/2"C	300N	350	4-350 KCMIL, 1#4 GND IN 3"C
			350	500	3-500 KCMIL, 1#3 GND IN 3"C	350N	500	4-500 KCMIL, 1#3 GND IN 3 1/2"C
			400	600	3-600 KCMIL, 1#3 GND IN 3 1/2"C	400N	600	4-600 KCMIL, 1#3 GND IN 4"C
			450	2-4/0	(2) 3#4/0, 1#2 GND IN 2"C	450N	2-4/0	(2) 4#4/0, 1#2 GND IN 2 1/2"C
			500	2-250	(2) 3-250 KCMIL, 1#2 GND IN 2 1/2"C	500N	2-250	(2) 4-250 KCMIL, 1#2 GND IN 2 1/2"C
			600	2-350	(2) 3-350 KCMIL, 1#1 GND IN 2 1/2"C	600N	2-350	(2) 4-350 KCMIL, 1#1 GND IN 3"C
			700	2-500	(2) 3-500 KCMIL, 1#1/0 GND IN 3"C	700N	2-500	(2) 4-500 KCMIL, 1#1/0 GND IN 3 1/2"C
			800	2-600	(2) 3-600 KCMIL, 1#1/0 GND IN 3 1/2"C	800N	2-600	(2) 4-600 KCMIL, 1#1/0 GND IN 4"C
			1000	3-500	(3) 3-500 KCMIL, 1#2/0 GND IN 3"C	1000N	3-500	(3) 4-500 KCMIL, 1#2/0 GND IN 3 1/2"C
			1200	3-600	(3) 3-600 KCMIL, 1#3/0 GND IN 4"C	1200N	3-600	(3) 4-600 KCMIL, 1#3/0 GND IN 4"C
			1600	4-600	(4) 3-600 KCMIL, 1#4/0 GND IN 4"C	1600N	4-600	(4) 4-600 KCMIL, 1#4/0 GND IN 4"C
			2000	5-600	(5) 3-600 KCMIL, 1-250 KCMIL GND IN 4"C	2000N	5-600	(5) 4-600 KCMIL, 1-250 KCMIL GND IN 4"C
			2500	7-500	(7) 3-500 KCMIL, 1-350 KCMIL GND IN 3 1/2"C	2500N	7-500	(7) 4-500 KCMIL, 1-350 KCMIL GND IN 3 1/2"C
			3000	8-500	(8) 3-500 KCMIL, 1-400 KCMIL GND IN 3 1/2"C	3000N	8-500	(8) 4-500 KCMIL, 1-400 KCMIL GND IN 3 1/2"C
			4000	10-600	(10) 3-600 KCMIL, 1-500 KCMIL GND IN 4"C	4000N	10-600	(10) 4-600 KCMIL, 1-500 KCMIL GND IN 4"C
			5000	12-600	(12) 3-600 KCMIL, 1-700 KCMIL GND IN 4"C	5000N	12-600	(12) 4-600 KCMIL, 1-700 KCMIL GND IN 4"C
			6000	15-600	(15) 3-600 KCMIL, 1-500 KCMIL GND IN 4"C	6000N	15-600	(15) 4-600 KCMIL, 1-800 KCMIL GND IN 4"C

NOTES:

1. AMPACITIES FOR FEEDER SIZES ARE BASED ON N.E.C. CODE 110-14. (TERMINATION PROVISIONS FOR EQUIPMENT RATED 100A OR LESS ARE RATED FOR USE WITH CONDUCTORS RATED 60°C. TERMINATION PROVISIONS FOR EQUIPMENT RATED GREATER THAN 100A ARE RATED FOR USE WITH CONDUCTORS RATED 75°C.).
2. CONDUIT FILL IS BASED ON 40% FILL USING SINGLE CONDUCTOR BUILDING WIRE OF INSULATION TYPES THHN, THWN, THWN-2, XHH, XHHW, AND XHHW-2 IN RMC. FOR OTHER RACEWAY TYPES REFER TO APPROPRIATE N.E.C. APPENDIX C TABLES.
3. EQUIPMENT GROUND SIZING BASED ON N.E.C. TABLE 250.122.

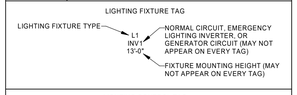
ELECTRICAL ABBREVIATIONS

ABBREV.	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
AWG	AMERICAN WIRE GAUGE
A	AMPERE
AF	AMPERE FUSE/AMPERE FRAME
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AIC	AVAILABLE INTERRUPTING CURRENT (AMPS)
CB	CIRCUIT BREAKER
C	CONDUIT OR CEILING MOUNTED
CU	COPPER
CT	CURRENT TRANSFORMER
DIA	DIAMETER
DISC	DISCONNECT
EWC	ELECTRIC WATER COOLER
EC	ELECTRICAL CONTRACTOR
EMT	ELECTRICAL METALLIC TUBING
EPO	EMERGENCY POWER OFF
(E)	EXISTING ELECTRICAL EQUIPMENT/WORK TO REMAIN
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FDC	FIRE DEPARTMENT CONNECTION
FLA	FULL LOAD AMPS
F	FUSE
G/GND	GROUND
GFCI/GFI	GROUND FAULT CIRCUIT INTERRUPTER
HOA	HAND-OFF-AUTO
HP	HORSEPOWER
IG	ISOLATED GROUND
INV	INVERTER
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWH	KILOWATT HOUR
LP	LIGHTING PANEL
MCB	MAIN CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MLO	MAIN LUG ONLY
MAX	MAXIMUM
MIN	MINIMUM
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOC.
N/NEU	NEUTRAL
NF	NON-FUSIBLE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NIC	NOT IN CONTRACT
PH/Ø	PHASE
P	POLE
PV	PHOTOVOLTAIC (SOLAR PHOTOVOLTAIC SYSTEM)
PVC	POLYVINYL CHLORIDE (PLASTIC)
PF	POWER FACTOR
(R)	RELOCATED EXISTING ELECTRICAL EQUIPMENT
RP	RECEPTACLE PANEL
(RR)	REMOVE AND REINSTALL
RMC	RIGID METALLIC CONDUIT
TBB	TELEPHONE BACKBOARD
XFMR	TRANSFORMER
TYP	TYPICAL
UC	UNDERCOUNTER
UL	UNDERWRITERS LABORATORIES
UPS	UNINTERRUPTIBLE POWER SUPPLY
USB	UNIVERSAL SERIAL BUS
UON	UNLESS OTHERWISE NOTED
V	VOLT
VA	VOLT AMPERE
W	WATT
WP	WEATHERPROOF
WG	WIRE GUARD

DRAWING NOTATION

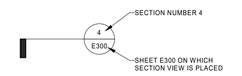
SYMBOL	DESCRIPTION
1	CONSTRUCTION KEYNOTE NUMBER 1
1	DEMOLITION KEYNOTE NUMBER 1
20	COPPER FEEDER SIZE TAG (REFER TO FEEDER SCHEDULE)
20	ALUMINUM FEEDER SIZE TAG (REFER TO FEEDER SCHEDULE)
EQUIPMENT	EQUIPMENT TAG
	EXISTING DEVICES OR EQUIPMENT
	NEW OR MODIFIED DEVICES OR EQUIPMENT
	NEW OR MODIFIED UNDERGROUND WIRING
	EXISTING SYSTEM COMPONENT TO BE REMOVED
	POINT OF NEW CONNECTION.

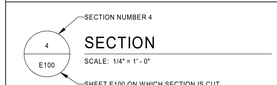
LIGHTING FIXTURE TAG



LIGHTING CONTROL TAG

NOTE: THE TAG DOES NOT REFLECT THE QUANTITY OF CONTROL DEVICES REQUIRED IN AREA.





DRAWING INDEX

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ES1.1	ELECTRICAL SITE LIGHTING PLAN
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EP1.4	POWER PLAN - UNIT 400
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EP2.2	POWER MECHANICAL EQUIPMENT PLAN - UNIT 200
EP2.3	POWER MECHANICAL EQUIPMENT PLAN - UNIT 300
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E4.0	ENLARGED ELECTRICAL PLANS
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E7.0	ELECTRICAL ONE-LINE/RISER DIAGRAM
E7.1	PHOTOVOLTAIC RISER DIAGRAM

POWER SYMBOL LIST

SYMBOL	DESCRIPTION
	CONDUIT DOWN
	CONDUIT UP
CR	CORD REEL
	DISCONNECT SWITCH - NON-FUSED
	DISCONNECT SWITCH - FUSED
	DISCONNECT SWITCH - COMBINATION MOTOR STARTER
FB	FLOOR BOX
	ELECTRICAL PANEL
	GROUNDING ROD
	GROUND
	GROUNDING BAR
J	JUNCTION BOX
M	METER
	MOTOR - SINGLE PHASE
	MOTOR - THREE PHASE
$M	MOTOR RATED SWITCH
PT	POKE-THRU
	RECEPTACLE - DUPLEX TYPE
	RECEPTACLE - DUPLEX TYPE 6" ABOVE COUNTER
USB	RECEPTACLE - DUPLEX/USB COMBINATION TYPE
	RECEPTACLE - QUADRUPLEX TYPE
	RECEPTACLE - SIMPLEX TYPE
	RECEPTACLE - SPECIALTY TYPE
T	TRANSFORMER
VFD	VARIABLE FREQUENCY DRIVE

NOTES:
1. ALL DEVICE RATINGS/SIZES SHALL BE COORDINATED WITH PLANS AND SCHEDULES.

TECHNOLOGY SYMBOL LIST

SYMBOL	DESCRIPTION
	BELL OUTLET
	CAMERA
CR	CARD READER - MOUNT AT 48" AFF
I	INTERCOM - MOUNT AT 48" AFF
KP	KEYPAD - MOUNT AT 48" AFF
	LOW VOLTAGE PANEL
MS	MOTION SENSOR - WALL - MOUNT AT 10'-0" AFF OR 6" BELOW CEILING
	PUSH BUTTON - MOUNT AT 48" AFF
S S	SPEAKER - WALL MOUNTED, CEILING MOUNTED
	TECHNOLOGY OUTLET - 6" ABOVE COUNTER
	TECHNOLOGY OUTLET - WALL
XXX	MULTIPLE BOX TECHNOLOGY INSTALLATION - REFER TO SHEET E5.0 FOR DETAIL
TV	TELEVISION OUTLET
	WALL CLOCK - SINGLE FACE
	WALL CLOCK - DOUBLE FACE
S	WALL CLOCK AND SPEAKER UNIT
WAP	WIRELESS ACCESS POINT

NOTES:
1. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR BOX AND CONDUIT FOR ALL DEVICES INDICATED.
2. LOW VOLTAGE CONTRACTOR SHALL PROVIDE EXACT SPECIFICATIONS AND LOCATIONS OF ALL DEVICES.

FIRE ALARM SYMBOL LIST

SYMBOL	DESCRIPTION
P	AUDIBLE DEVICE - CEILING MOUNTED
F	AUDIBLE DEVICE - WALL MOUNTED
C	CARBON DIOXIDE ALARM
CO	CARBON MONOXIDE ALARM
	COMBINATION AUDIBLE/VISUAL DEVICE - CEILING MOUNTED
F	COMBINATION AUDIBLE/VISUAL DEVICE - WALL MOUNTED
CS	COMBINATION CARBON MONOXIDE ALARM/SMOKE DETECTOR
EXISTING / NEW	COMBINATION FIRE/SMOKE DAMPER (VERTICAL)
EXISTING / NEW	COMBINATION FIRE/SMOKE DAMPER (HORIZONTAL)
S	DUCT MOUNTED SMOKE DETECTOR
FAA	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FD	FIRE DEPARTMENT COMMUNICATION OUTLET
FS	FLOW SWITCH
H	HEAT DETECTOR
I/O	INPUT/OUTPUT CONTROL MODULE
DH	MAGNETIC DOOR HOLDER
F	MANUAL PULL STATION
S S	SMOKE DETECTOR - WALL MOUNTED, CEILING MOUNTED
S	SMOKE DETECTOR WITH AUDIO
TS	TAMPER SWITCH
F	VISUAL DEVICE - CEILING MOUNTED
F	VISUAL DEVICE - WALL MOUNTED

NOTES:
1. DRAWINGS INDICATE DESIGN INTENT ONLY. FINAL LOCATIONS AND DEVICE SPECIFICATIONS SHALL BE PROVIDED BY FIRE ALARM MANUFACTURER. REFER TO PROJECT SPECIFICATIONS FOR APPROVED MANUFACTURERS.
2. FIRE DETECTION AND SIGNALING DEVICES ARE SHOWN FOR COORDINATION PURPOSES. FINAL SYSTEM DESIGN TO BE PERFORMED BY CONTRACTOR AND SUPPLIER FOR OFFICIAL SUBMISSION. COORDINATE ALL DEVICE QUANTITIES AND LOCATIONS WITH SUPPLIER PRIOR TO INSTALLATION. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY PATHWAYS, POWER SUPPLIES AND DEVICES PER SUPPLIER CONTRACT DOCUMENTS.

APPLICABLE CODES AND REGULATIONS

YEAR	CODE
2015	MICHIGAN BUILDING CODE
2015	MICHIGAN ENERGY CODE
2015	MICHIGAN REHABILITATION CODE
2017	MICHIGAN ELECTRICAL CODE RULES, PART 8
2017	NATIONAL ELECTRICAL CODE (NFPA 70)
2013	NFPA 20
2013	NFPA 72
2013	NFPA 101
2013	NFPA 110
2009	ICC A117.1 ACCESSIBLE AND USABLE BUILDINGS & FACILITIES

LIGHTING CONTROLS LEGEND

SYMBOL	DESCRIPTION
$L	LIGHT CONTROL LOCATION
$	SWITCH - SINGLE POLE
$3	SWITCH - THREE WAY
$4	SWITCH - FOUR WAY

FLOOR BOX SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL NO.	REQUIRED CONNECTIONS	CONDUIT	FINISH	LOCATION	REMARKS
A	SIX GANG, MULTI-SERVICE STAMPED STEEL FOR FLOOR SLAB APPLICATION, RECESSED FLOOR BOX	WIREMOLD	EFB6 CAST-N	1 A/V PLATE 2 DATA PLATES 2 DUPLEX POWER REC 1 BLANK	(1) 1-1/4" C - A/V (1) 1" C - DATA (1) 3/4" C - POWER	BLACK	CONFERENCE 116	UNDER CONFERENCE ROOM TABLE
B	SIX GANG, MULTI-SERVICE STAMPED STEEL FOR FLOOR SLAB APPLICATION, RECESSED FLOOR BOX	WIREMOLD	EFB6 CAST-N	1 A/V PLATE 2 SCORE BOARD CONN. PLATES 2 DATA PLATES 1 DUPLEX POWER REC	(1) 1-1/4" C - A/V (2) 1" C - SCOREBOARDS (1) 1" C - DATA (1) 3/4" C - POWER	MATCH GYM FLOOR	GYMNASIUM 156	SCORER'S TABLE

NOTES:
1. PROVIDE 1 1/4"C FROM EACH DATA FLOOR BOX (GANG) TO ACCESSIBLE LOCATION IN CEILING.
2. COORDINATE ALL DATA, A/V AND TECHNOLOGY OUTLETS WITH LOW VOLTAGE CONTRACTORS.
3. PROVIDE PULLSTRINGS FOR ALL INSTALLED EMPTY CONDUITS.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050102
PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ELECTRICAL GENERAL INFORMATION

SHEET NO.
E0.0

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LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL	WATTAGE	LUMENS	VOLTAGE	CCT	CRI	REMARKS	ALTERNATE MANUFACTURER | MODEL #1	ALTERNATE MANUFACTURER | MODEL #2
L1	2' X 4' BACKLIT RECESSED FLAT PANEL.	DAY-BRITE	2 FPZ 48L 840 4 DS UNV DIM	38 W	4,800	277	4000K	80		ORACLE LIGHTING 24 FPL BL LED SERIES	LITHONIA CPX SERIES
L2	2" WIDE RECESSED LINEAR PERIMETER LUMINAIRE. REFER TO ARCHITECTURAL PLANS AND DETAILS FOR RUN LENTHS. LENGTHS VARY.	STARFIRE LIGHTING	VRP2-L 8 40 S S 1 X PB W	4 W	400 LM/FT	277	4000K	80	WATTAGE SHOWN IS PER LINEAR FOOT. REFER TO LIGHTING PLANS FOR RUN LENGTHS.	LITECONTROL 2L-WS-D SERIES	FOCAL POINT SEEM 2 SERIES
L3	4" SQUARE RECESSED DOWNLIGHT.	LIGHTHEADED	T3SSF T WS 00 OPEN B60 40 9010 P 277 RP3 F T	14 W	1,400	277	4000K	90		PRESCOLITE LITEFRAME 2.0 SQUARE SERIES	LITHONIA LDN4 SQUARE SERIES
L4	4" WIDE BY 8' LONG DIRECT/INDIRECT DECORATIVE LINEAR PENDANT.	LIGHTLY	G 6 C 8' N N H A M 40 R Z N	82 W	900 LM/FT	277	4000K	80	OWNER/ARCHITECT APPROVED	NONE	
L5	4" WIDE BY 4' LONG DIRECT LINEAR PENDANT WITH WIRE GUARD	DAY-BRITE	FSS 4 55L 840 UNV DIM FSTH FSSWG4	41 W	5,500	277	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	COLUMBIA MPS SERIES	LITHONIA CLX SERIES
L6	4" SQUARE RECESSED DOWNLIGHT.	LIGHTHEADED	T3SSF T WS 00 OPEN B70 40 8014 P 277 RP3 F T	18 W	1,775	277	4000K	80		LITECONTROL 2L-WS-D SERIES	LITHONIA LDN4 SQUARE SERIES
L7	16" DIAMETER HIGH BAY PENDANT.	LIGHTOLIER	3DP IHB BL M CL LF DGYS LF 20L 940	149 W	20,000	277	4000K	90	MOUNT BOTTOM 18'-0" AFF UNLESS NOTED OTHERWISE	COLUMBIA SAVVANO SERIES	SPECTRUM LIGHTING DMD SERIES
L8	4" WIDE BY 8' LONG DIRECT DECORATIVE LINEAR PENDANT.	LIGHTLY	G 6 C 8' N N T A M 40 R Z N	60 W	1,250 LM/FT	277	4000K	80	OWNER/ARCHITECT APPROVED	NONE	
L9	2" WIDE BY 6' LONG DIRECT DECORATIVE LINEAR PENDANT.	LEDALITE	12 O 1 L A C Q S 08 7 D E W A3 144	92 W	1,220 LM/FT	277	4000K	90	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	NONE	
L10A	2" WIDE BY 6' LONG DIRECT DECORATIVE ACOUSTICAL LINEAR PENDANT.	LUX BOXX	LN 6' H1 B X 40 DB U1	48 W	1,000 LM/FT	277	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	PICASSO ECHO SERIES	FOCAL POINT SEEM 2 ACOUSTIC SERIES
L10B	2" WIDE BY 10' LONG DIRECT DECORATIVE ACOUSTICAL LINEAR PENDANT.	LUX BOXX	LN 10' H1 B X 40 DB U1	80 W	1,000 LM/FT	277	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	PICASSO ECHO SERIES	FOCAL POINT SEEM 2 ACOUSTIC SERIES
L11	2" WIDE RECESSED LINEAR LUMINAIRE.	METALUMEN RAIL SERIES	RM2D 1L40K 4' C 90 deg 4' 4' MB SA L1 1 D 4	4 W	350 LM/FT	277	4000K	80		LITECONTROL 2L-R-D SERIES	FOCAL POINT SEEM 2 SERIES
L12	DIRECT LIGHT ONLY DECORATIVE ACOUSTICAL LINEAR PENDANT. 'Y' SHAPE	LUX BOXX	TE M H1 B X 40 DB U1	16 W	6,100	277	4000K	80		PICASSO ECHO SERIES	FOCAL POINT SEEM 2 ACOUSTIC SERIES
L13	26" WIDE BY 4" TALL WALL MOUNTED VANITY.	AFX LIGHTING	APV270520LAJD2ES-LW	35 W	3,000	277	4000K	80		ASL RFTB-WG SERIES	KUZCO MELVILLE SERIES
L14	2' X 4' BACKLIT RECESSED FLAT PANEL.	DAY-BRITE	2 FPZ 43L 840 4 DS UNV DIM	31 W	4,300	277	4000K	80		ORACLE LIGHTING 24 FPL BL LED SERIES	LITHONIA CPX SERIES
L15	4" WIDE BY 4' LONG RECESSED LINEAR, VANDAL RESISTANT, HIGH ABUSE	L.C. DOANE	VRR 14 1W40 40 80 N S W VAR DM 122 00 AP D	41 W	4,400	277	4000K	80		NEW STAR CPP SERIES	KENALL CSEDI14 SERIES
L16	2" WIDE DIRECT LIGHT ONLY DECORATIVE ACOUSTICAL LINEAR PENDANT. 'Y' SHAPE. TUNABLE WHITE.	LUX BOXX	TE M H1 B X COLOR TUNING DB U1	16 W	6,000	277	2700K-5000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	PICASSO ECHO SERIES	FOCAL POINT SEEM 2 ACOUSTIC SERIES
L17	2" WIDE BY 4' LONG RECESSED LINEAR LUMINAIRE.	METALUMEN RAIL SERIES	RM2D 1L40K 4' MB SA L1 1 D 4	4 W	350 LM/FT	277	4000K	80		LITECONTROL 2L-R-D SERIES	FOCAL POINT SEEM 2 SERIES
L18	2' X 2' RECESSED ARCHITECTURAL TROFFER. RGBW COLOR	LSI LIGHTING	TRI22 RGBW UNV	41 W	4,800	277	RGBW	80		ORACLE LIGHTING 22-OD1V LED SERIES RGBW	MARK ARCHITECTURAL WHISPER RGBW
L19A	4' LONG T-BAR MOUNT LINEAR LUMINAIRE.	GOLDENEYE	AL 1.0 SC 48 40K 80+ X	6 W	700 LM/FT	277	4000K	80		JLC-TECH LLC T-BAR ECHO HIGH OUTPUT SERIES	NONE
L19B	6' LONG T-BAR MOUNT LINEAR LUMINAIRE.	GOLDENEYE	AL 1.0 SC 72 40K 80+ X	4 W	700 LM/FT	277	4000K	80		JLC-TECH LLC T-BAR ECHO HIGH OUTPUT SERIES	NONE
L19C	8' LONG T-BAR MOUNT LINEAR LUMINAIRE.	GOLDENEYE	AL 1.0 SC 96 40K 80+ X	6 W	700 LM/FT	277	4000K	80		JLC-TECH LLC T-BAR ECHO HIGH OUTPUT SERIES	NONE
L20	4" WIDE BY 4' LONG DIRECT LINEAR PENDANT WITH WIRE GUARD	DAY-BRITE	FSS 4 40L 840 UNV DIM FSTH FSSWG4	31 W	4,100	277	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	COLUMBIA MPS SERIES	LITHONIA CLX SERIES
L21	4" SQUARE RECESSED DOWNLIGHT.	LIGHTHEADED	T3SSF T WS 00 OPEN B40 40 9510 P 277 RP3 F T	14 W	900	277	4000K	90		PRESCOLITE LITEFRAME 2.0 SQUARE SERIES	LITHONIA LDN4 SQUARE SERIES
L22	2" WIDE BY 8' LONG DIRECT LINEAR PENDANT.	METALUMEN	RM2D 1L40K 8 MB SA L2 PAA UNV	64 W	400 LM/FT	277	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	LITECONTROL 2L-P-D SERIES	FOCAL POINT SEEM 2 SERIES
L23	4" WIDE BY 4' LONG DIRECT LINEAR PENDANT.	DAY-BRITE	FSS 4 55L 840 UNV DIM FSTH FSSWG4	41 W	5,500	120	4000K	80	MOUNT BOTTOM 10'-0" AFF UNLESS NOTED OTHERWISE.	COLUMBIA MPS SERIES	LITHONIA CLX SERIES
O1	BWL PROVIDED AND INSTALLED. SHOWN FOR REFERENCE ONLY			80 W							
O2	BWL PROVIDED AND INSTALLED. SHOWN FOR REFERENCE ONLY			112 W							
O3	BWL PROVIDED AND INSTALLED. SHOWN FOR REFERENCE ONLY			224 W							
O4	BWL PROVIDED AND INSTALLED. SHOWN FOR REFERENCE ONLY			130 W							
S1	EXTERIOR WALL MOUNT FIXTURE. TYPE III DISTRIBUTION.	GARDCO	GBS AD1 840 T4M UNV OC	10 W	1,700	277	4000K	80	MOUNT BOTTOM 8'-6" AFG UNLESS NOTED OTHERWISE.	ZANEEN EXTERIOR SPECIAL SURFACE	LUMENPULSE LUMENBLADE NANO SERIES
S2	5" SQUARE RECESSED DOWNLIGHT. EXTERIOR RATED.	LIGHTHEADED	2-516 T 01 BRO60 40 9010 WET R T 3 P 277WP	11 W	1,000	277	4000K	80		PRESCOLITE LITEFRAME 2.0 SQUARE SERIES	LITHONIA LDN4 SQUARE SERIES
S4	EXTERIOR POST TOP LIGHT FOR FLAG POLES	CONCORD AMERICAN FLAGPOLE	ABW2-25FP-SAT	10 W	572	277	4000K	80		NONE	
S5	4" DIAMETER EXTERIOR RATED SPOT. REQUIRES TRANSFORMER.	LUMASCAPE	LS1015 22W 840 NM 30-48 VDC PS SL	26 W	1,700	277	4000K	80	MOUNT TRANSFORMER ABOVE ACCESSIBLE CEILING IN MAIN OFFICE. ARCHITECT TO CONFIRM THE FINISH.	AMERLUX ROOK ACCENT X EXTERIOR	ECOSENSE RISE FO80 SERIES
S6	2" WIDE BY 4' LONG SURFACE MOUNT DIRECT-ONLY LINEAR WITH MOUNTING BRACKET	THE SMART LIGHTING CO.	HB3014 48 41K 15 AC D 4 AL-HB3P-72 ENDCAP CU HB30EXT-12 CU	5 W	450 LM/FT	277	4000K	80	WATTAGE SHOWN IS PER LINEAR FOOT. ARCHITECT TO SELECT CUSTOM FINISH TO MATCH BRICK GLAZING/METAL DRIP EDGE	INSIGHT LIGHTING PILOT EXTERIOR	ECOSENSE TROV L50 GRAZE EXTERIOR
S6A	2" WIDE BY 1' LONG SURFACE MOUNT DIRECT-ONLY LINEAR WITH MOUNTING BRACKET	THE SMART LIGHTING CO.	HB3014 12 41K 15 AC D 4 AL-HB3P-72 ENDCAP CU HB30EXT-12 CU	5 W	450 LM/FT	277	4000K	80	WATTAGE SHOWN IS PER LINEAR FOOT. ARCHITECT TO SELECT CUSTOM FINISH TO MATCH BRICK GLAZING/METAL DRIP EDGE	INSIGHT LIGHTING PILOT EXTERIOR	ECOSENSE TROV L50 GRAZE EXTERIOR
S6B	2" WIDE BY 2' LONG SURFACE MOUNT DIRECT-ONLY LINEAR WITH MOUNTING BRACKET	THE SMART LIGHTING CO.	HB3014 24 41K 15 AC D 4 AL-HB3P-72 ENDCAP CU HB30EXT-12 CU	5 W	450 LM/FT	277	4000K	80	WATTAGE SHOWN IS PER LINEAR FOOT. ARCHITECT TO SELECT CUSTOM FINISH TO MATCH BRICK GLAZING/METAL DRIP EDGE	INSIGHT LIGHTING PILOT EXTERIOR	ECOSENSE TROV L50 GRAZE EXTERIOR
S6C	2" WIDE BY 3' LONG SURFACE MOUNT DIRECT-ONLY LINEAR WITH MOUNTING BRACKET	THE SMART LIGHTING CO.	HB3014 36 41K 15 AC D 4 AL-HB3P-72 ENDCAP CU HB30EXT-12 CU	5 W	450 LM/FT	277	4000K	80	WATTAGE SHOWN IS PER LINEAR FOOT. ARCHITECT TO SELECT CUSTOM FINISH TO MATCH BRICK GLAZING/METAL DRIP EDGE	INSIGHT LIGHTING PILOT EXTERIOR	ECOSENSE TROV L50 GRAZE EXTERIOR
S7	EXTERIOR WALL MOUNT FIXTURE. TYPE III DISTRIBUTION.	GARDCO	GBS AD1 840 T4M UNV OC	10 W	1,700	120	4000K	80	MOUNT BOTTOM 8'-6" AFG UNLESS NOTED OTHERWISE.	ZANEEN EXTERIOR SPECIAL SURFACE	LUMENPULSE LUMENBLADE NANO SERIES
X1	EDGE LIT LED EXIT SIGN.	CHLORIDE	44RLU1/2GM	3 W		277	GREEN LETTERS		REFER TO PLANS FOR MOUNTING STYLE, DIRECTIONAL ARROWS, AND NUMBER OF FACES.	BEGHELLI BRUNO SERIES	LITHONIA EDG-EDGR SERIES
X2	DIE-CAST ALUMINUM LED EXIT SIGN. PROVIDE WITH WIRE CAGE.	CHLORIDE	46L 1/2 G WG4	3 W		277	GREEN LETTERS		REFER TO PLANS FOR MOUNTING STYLE, DIRECTIONAL ARROWS, AND NUMBER OF FACES.	BEGHELLI FORMA SERIES	LITHONIA LQC SERIES

EQUALS TO BE APPROVED BY ENGINEER AND ARCHITECT. ANY ALTERNATES PROVIDED TO CONTRACTOR WITHOUT PRIOR APPROVAL FROM ENGINEER AND ARCHITECT WILL BE REJECTED.

LIGHTING INVERTER EQUIPMENT SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL	WATTAGE	REMARKS
L-INV2	1250 WATT EMERGENCY LIGHTING INVERTER	ONLINE POWER	MW: 1.2R 2500 T1	1250 W	
L-INV3	1250 WATT EMERGENCY LIGHTING INVERTER	ONLINE POWER	MW: 1.2R 2500 T1	1250 W	
L-INV4	1250 WATT EMERGENCY LIGHTING INVERTER	ONLINE POWER	MW: 1.2R 2500 T1	1250 W	

L-INV2 SCHEDULE UNIT 200

TYPE	WATTAGE	COUNT	LEVEL
L3	98 W	7	FIRST FLOOR
L5	41 W	1	FIRST FLOOR
L6	18 W	1	FIRST FLOOR
L9	552 W	6	FIRST FLOOR
L10A	48 W	1	FIRST FLOOR
L17	96 W	6	FIRST FLOOR
L20	62 W	2	FIRST FLOOR
S1	20 W	2	FIRST FLOOR
X1	45 W	15	FIRST FLOOR
TOTAL LOAD:	980 W		

PROVIDE UL924 EMERGENCY TRANSFER DEVICE FOR EACH FIXTURE LISTED IN INVERTER SCHEDULE.

L-INV3 SCHEDULE UNIT 300

TYPE	WATTAGE	COUNT	LEVEL
L3	84 W	6	FIRST FLOOR
L5	41 W	1	FIRST FLOOR
L6	18 W	1	FIRST FLOOR
L9	552 W	6	FIRST FLOOR
L10B	160 W	2	FIRST FLOOR
L17	32 W	2	FIRST FLOOR
L19A	72 W	3	FIRST FLOOR
L20	62 W	2	FIRST FLOOR
S1	20 W	2	FIRST FLOOR
X1	15 W	5	FIRST FLOOR
TOTAL LOAD:	1056 W		

PROVIDE UL924 EMERGENCY TRANSFER DEVICE FOR EACH FIXTURE LISTED IN INVERTER SCHEDULE.

L-INV4 SCHEDULE UNIT 400

TYPE	WATTAGE	COUNT	LEVEL
L3	84 W	6	FIRST FLOOR
L6	18 W	1	FIRST FLOOR
L9	552 W	6	FIRST FLOOR
L10B	160 W	2	FIRST FLOOR
L17	32 W	2	FIRST FLOOR
L19A	72 W	3	FIRST FLOOR
L19B	24 W	1	FIRST FLOOR
L20	62 W	2	FIRST FLOOR
S1	20 W	2	FIRST FLOOR
X1	15 W	5	FIRST FLOOR
TOTAL LOAD:	1039 W		

PROVIDE UL924 EMERGENCY TRANSFER DEVICE FOR EACH FIXTURE LISTED IN INVERTER SCHEDULE.

LIGHTING CONTROLS MATRIX

TAG NUMBER	SPACE TYPE	PARAMETERS												SEQUENCE OF OPERATIONS
		MANUAL ON/OFF SWITCH	DIMMING SWITCH	OVERRIDE SWITCH	MULTI ZONE CONTROL	KEY SWITCH	TIMECLOCK	OCCUPANCY SENSOR	PHOTOCONTROL DIMMING	EXTERIOR PHOTOCELL	COLOR TUNING	RGB/RGBW	BACNET INTEGRATION	
1	PRIVATE OFFICE, CLINIC, SUPPORT, WORK	X	X					X						MANUAL ON/AUTOMATIC OFF WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE (VACANCY MODE). CONTINUOUS DIMMING.
2	CONFERENCE, RESOURCE ROOM, CLASSROOM, CAFETERIA	X	X		X			X						MANUAL ON/AUTOMATIC OFF WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE (VACANCY MODE). CONTINUOUS DIMMING. AUTOMATIC DAYLIGHT RESPONSIVE CONTROLS FOR DAYLIGHT ZONE 1 AND DAYLIGHT ZONE 2, IF ZONE 2 IS PRESENT.
3	VESTIBULE						X	X						AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR OR SCHEDULED TIME FUNCTION. AUTOMATIC PARTIAL OFF TO 50% VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE. SCHEDULED SHUTOFF VIA SCHEDULED TIME FUNCTION.
4	WELCOME	X	X		X			X						MANUAL ON/AUTOMATIC OFF WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE (VACANCY MODE). CONTINUOUS DIMMING.
5	CORRIDOR			X	X		X	X						AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR OR SCHEDULED TIME FUNCTION. AUTOMATIC PARTIAL OFF TO 50% VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE. SCHEDULED SHUTOFF VIA SCHEDULED TIME FUNCTION.
6	RESTROOM - MULTI PERSON							X						AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR. AUTOMATIC FULL OFF VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE.
7	RESTROOM - SINGLE, CHANGING, SHOWER	X						X						LOCAL CONTROL SWITCH WITH ON/OFF FUNCTION. AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR. AUTOMATIC FULL OFF VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE.
8	GYM		X			X		X						LOCAL CONTROL SWITCH WITH ON/OFF AND DIM FUNCTION. AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR OR SCHEDULED TIME FUNCTION. AUTOMATIC PARTIAL OFF TO 50% VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE. SCHEDULED SHUTOFF VIA SCHEDULED TIME FUNCTION.
9	STORAGE ROOM	X						X						LOCAL CONTROL SWITCH WITH ON/OFF FUNCTION. AUTOMATIC ON TO FULL VIA OCCUPANCY SENSOR. AUTOMATIC FULL OFF VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE.
10	MECH/ELECTRICAL	X												LOCAL CONTROL SWITCH WITH ON/OFF FUNCTION.
11	COLLABORATION AREA	X	X		X			X						MANUAL ON/AUTOMATIC OFF WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE (VACANCY MODE). CONTINUOUS DIMMING.
12	SENSORY ROOM	X	X					X			X	X		WALL MOUNTED TOUCH PAD. ON/OFF, DIMMING, COLOR TUNING PRESETS, RGBW SELECTACLE. AUTOMATIC FULL OFF VIA OCCUPANCY SENSOR (VACANCY MODE) WITHIN 20 MIN OF OCCUPANTS LEAVING SPACE.
13	EXTERIOR EGRESS/SECURITY LIGHTING			X			X			X				MANUAL OVERRIDE SWITCH WITH ON/OFF AND DIM FUNCTION. AUTOMATIC ON TO FULL VIA SCHEDULED TIME FUNCTION OR PHOTOCELL. AUTOMATIC LIGHT LEVEL REDUCTION TO 70% AFTER HOURS VIA SCHEDULED TIME FUNCTION. FULL SHUTOFF VIA SCHEDULED TIME FUNCTION OR PHOTOSENSOR.
14	EXTERIOR FLAG POLE LIGHTING			X			X			X				MANUAL OVERRIDE SWITCH WITH ON/OFF AND DIM FUNCTION. AUTOMATIC ON TO FULL VIA SCHEDULED TIME FUNCTION OR PHOTOCELL. AUTOMATIC LIGHT LEVEL REDUCTION TO 70% AFTER HOURS VIA SCHEDULED TIME FUNCTION. FULL SHUTOFF VIA SCHEDULED TIME FUNCTION OR PHOTOSENSOR.
15	EXTERIOR FAÇADE LIGHTING			X	X		X			X				MANUAL OVERRIDE SWITCH WITH ON/OFF AND DIM FUNCTION. AUTOMATIC ON TO FULL VIA SCHEDULED TIME FUNCTION OR PHOTOCELL. LIGHTING SHALL BE TURNED OFF FROM 12AM TO 6AM. FULL SHUTOFF VIA SCHEDULED TIME FUNCTION OR PHOTOSENSOR.

PLEASE RECYCLE

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KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050400
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
LIGHTING SCHEDULES

SHEET NO.
E0.1

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POWER GENERAL NOTES

1. ALL RECEPTACLES ON EXTERIOR, IN KITCHEN, IN CONCESSION, IN LABORATORY, AND WITHIN 6'-0" OF SINK OR OTHER WATER SUPPLY SHALL BE READILY ACCESSIBLE GFCI TYPE RECEPTACLE.
2. REFER TO ARCHITECTURAL FLOOR PLANS AND ELEVATIONS TO VERIFY LOCATION OF DEVICES.
3. ALL CONDUITS SERVING 120 VOLTS OR GREATER SHALL INCLUDE A GROUND WIRE.
4. ALL CONDUITS SHALL BE ROUTED CONCEALED UNLESS NOTED OTHERWISE.
5. ALL 120 VOLT CIRCUITS SHALL UTILIZE A SEPARATE NEUTRAL.

ELECTRICAL ENLARGED KEYNOTES

E1 ELECTRICAL CONTRACTOR SHALL PROVIDE A DISCONNECT FOR FIRE DOOR AND BACK-BOX AND CONDUIT FOR CONTROLS. COORDINATE CONNECTION POINT AND CONTROLS LOCATION WITH INSTALLATION INSTRUCTIONS. ELECTRICAL CONTRACTOR TO MAKE ALL FINAL 120/208V CONNECTIONS.

E2 ELECTRICAL CONTRACTOR SHALL PROVIDE A DISCONNECT FOR COIL DOOR AND BACK-BOX AND CONDUIT FOR CONTROLS. COORDINATE CONNECTION POINT AND CONTROLS LOCATION WITH INSTALLATION INSTRUCTIONS. ELECTRICAL CONTRACTOR TO MAKE ALL FINAL 120/208V CONNECTIONS.

E3 PROVIDE SINGLE GANG PEDESTAL HOUSING FLOOR BOX MOUNTED ON FLOOR FOR FOOD SERVICE EQUIPMENT ELECTRICAL CONNECTIONS. MAXIMUM HEIGHT OF PEDESTAL MOUNT SHALL BE LESS THAN 4" AFF. COORDINATE EXACT LOCATION WITH FOOD SERVICE CONTRACTOR AND ARCHITECTURAL TRADES PRIOR TO ROUGH-IN.

E4 PROVIDE SPARE J-BOX AND CONDUIT FROM P.O.S. SYSTEM TO LOCATION INDICATED, FOR COMPUTER TERMINAL. COORDINATE FINAL LOCATION WITH OWNER'S REPRESENTATIVE PRIOR TO ROUGH-IN.

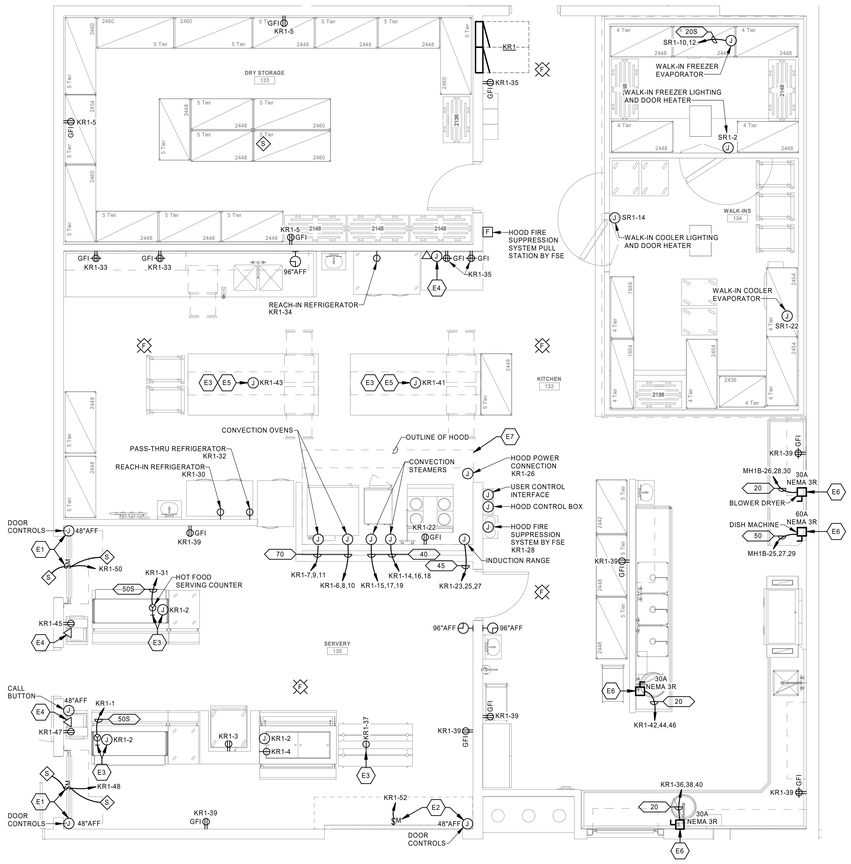
E5 PROVIDE FINAL CONNECTIONS TO PRE-WIRED COUNTERS. ALL WIRING, CONDUIT, RECEPTACLES, JUNCTION BOXES AND G.F.C.I.S PROVIDED AS PART OF COUNTER.

E6 PROVIDE A ROTARY STYLE ENCLOSED DISCONNECT LOCATED UNDER THE COUNTER, IN AN ACCESSIBLE LOCATION.

E7 PROVIDE SHUNT TRIP BREAKERS IN PANEL FOR ALL EQUIPMENT LOCATED UNDER HOOD. BREAKERS SHALL ACTIVATE UPON ACTIVATION OF HOOD SUPPRESSION SYSTEM.

ELECTRICAL CONTRACTOR TO COORDINATE FINAL POWER DEVICE QUANTITIES, RATINGS, HEIGHTS, AND LOCATIONS WITH FINAL FOOD SERVICE EQUIPMENT DRAWINGS ON FS-SERIES SHEETS PRIOR TO INSTALLATION.

FIRE ALARM VENDOR TO REVIEW FS-SERIES SHEETS PRIOR TO AND AS PART OF FINAL SUBMITTAL.



1 EP1.1A **ENLARGED KITCHEN POWER PLAN**
SCALE: 1/4" = 1'-0"

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201000094
PROFESSIONAL ENGINEER

01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ENLARGED ELECTRICAL PLANS

SHEET NO.
E4.0

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ELECTRICAL CONTRACTOR TO COORDINATE FINAL SIZES, QUANTITIES, HEIGHTS, AND LOCATIONS FOR LOW VOLTAGE BACKBOX AND CONDUIT WITH LOW VOLTAGE DOCUMENTS ON T-SERIES SHEETS PRIOR TO INSTALLATION.

ELECTRICAL CONTRACTOR TO PROVIDE WALL SLEEVES AS SHOWN ON POWER DOCUMENTS AS WELL AS ANY ADDITIONAL SLEEVES NEEDED DURING CONSTRUCTION FOR LOW VOLTAGE INSTALLER CABLE PATHWAYS.

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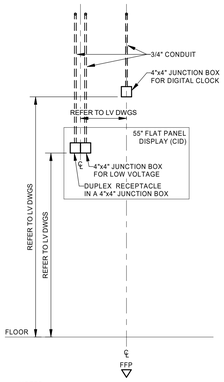
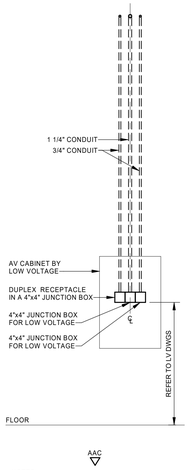


NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

FAMILY ROOM FLAT PANEL (FFP) DETAIL
NO SCALE



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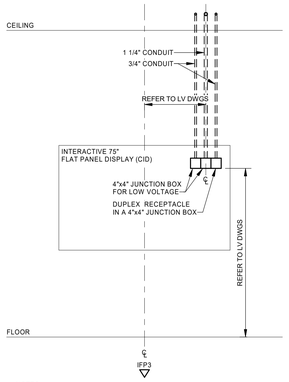
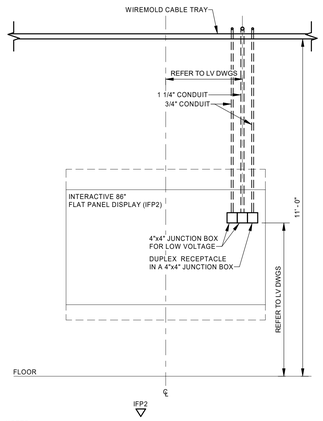
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

AUDIO & VIDEO CABINET (AAC) DETAIL
NO SCALE



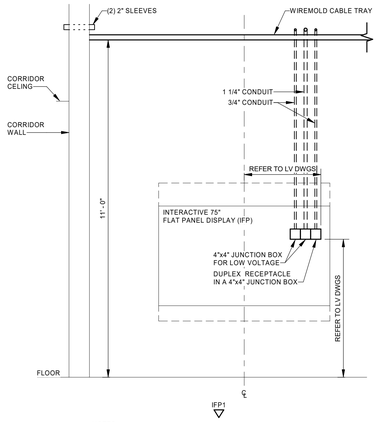
NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

CONFERENCE ROOM INTERACTIVE PANEL (IFP3) DETAIL
NO SCALE



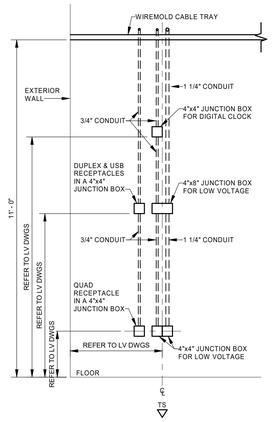
NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

MUSIC ROOM INTERACTIVE FLAT PANEL (IFP2) DETAIL
NO SCALE



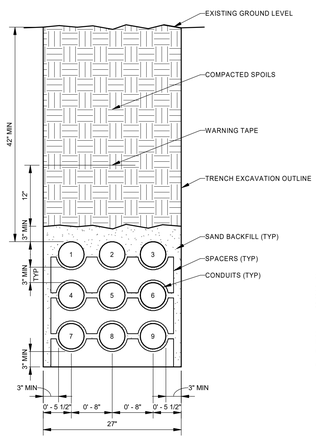
NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

TYPICAL CLASSROOM INTERACTIVE FLAT PANEL (IFP1) DETAIL
NO SCALE



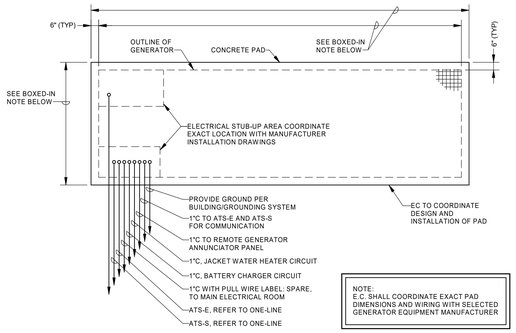
NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

TYPICAL CLASSROOM TEACHER STATION (TS) DETAIL
NO SCALE



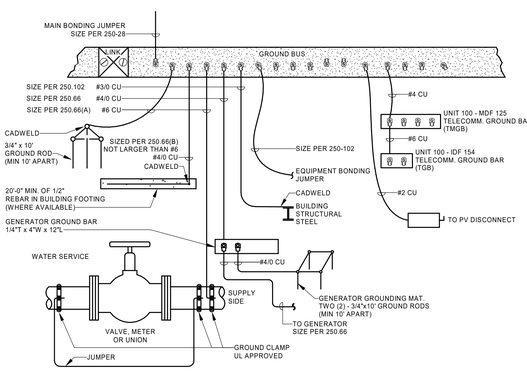
NOTE:
DUCT BANK CONFIGURATION MAY BE ALTERED DURING INSTALLATION BY THE E.C. FOR EASE OF CONSTUCTABILITY AND AS QUANTITY OF CONDUITS VARY AS LONG AS SPACING AS SHOWN IS MAINTAINED.

DIRECT BURIAL DUCT BANK CONDUIT DETAIL
NO SCALE

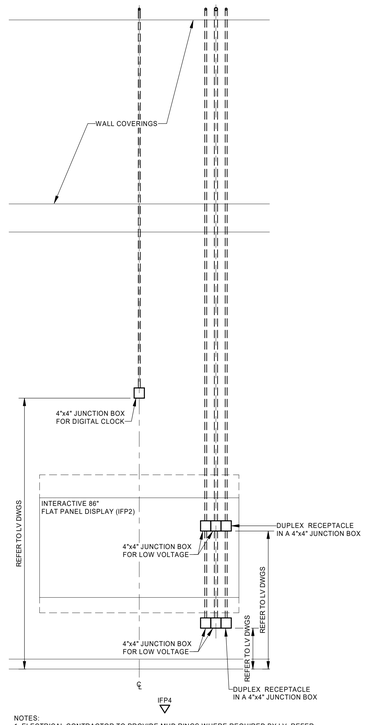


NOTE:
E.C. SHALL COORDINATE EXACT PAD DIMENSIONS AND WIRING WITH SELECTED GENERATOR EQUIPMENT MANUFACTURER

TYPICAL GENERATOR CONDUIT AND WIRING PLAN
NO SCALE

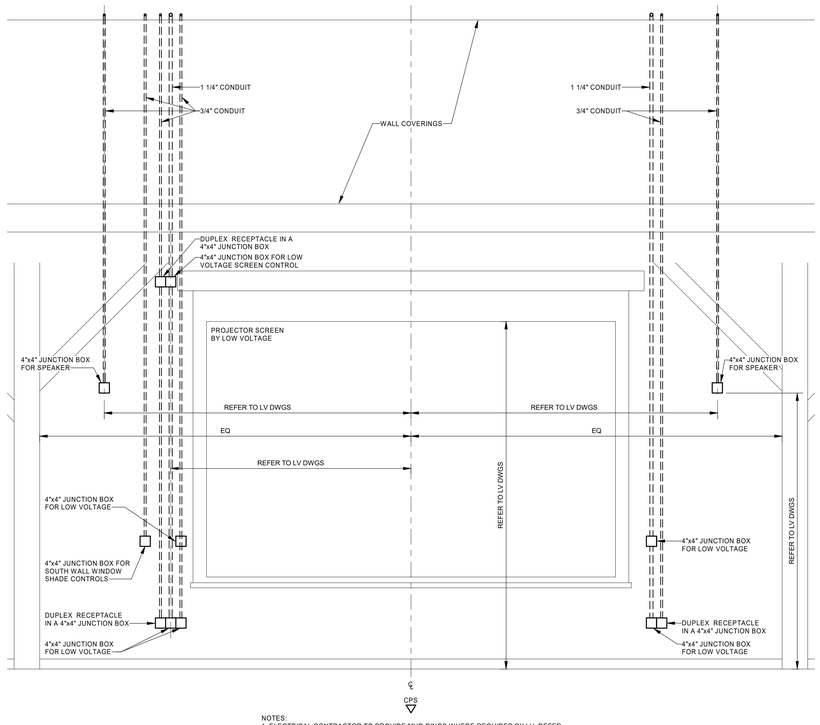


BUILDING/GROUNDING SYSTEM
NO SCALE



NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

CAFETERIA INTERACTIVE FLAT PANEL (IFP4) DETAIL
NO SCALE



NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE MUD RINGS WHERE REQUIRED BY LV. REFER TO SPECIFICATION FOR POWER DEVICES COVERS.
2. REFER TO LOW VOLTAGE DETAILS SHEETS T9.1 THRU T9.3 FOR MORE INFORMATION.

CAFETERIA PROJECTOR SCREEN WALL (CPS) DETAIL
NO SCALE

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201065193
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ELECTRICAL DETAILS

SHEET NO.
E5.0

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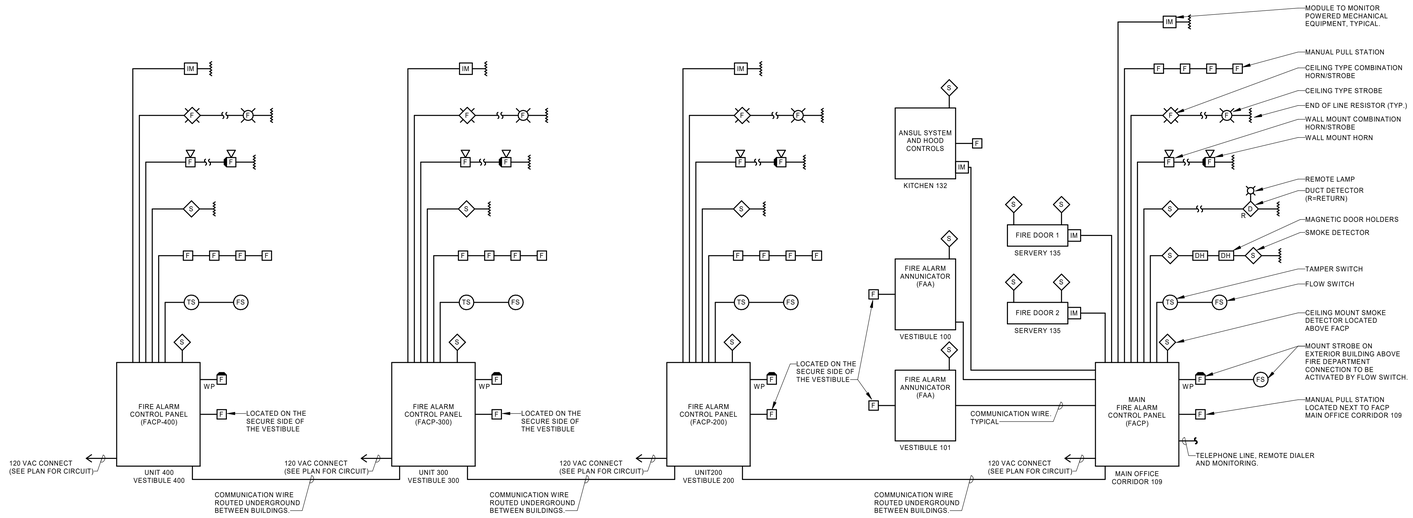


NEW PARTIAL FIRE ALARM RISER
NO SCALE

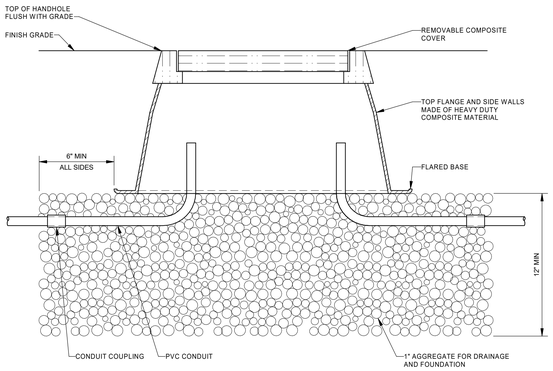
FIRE ALARM RISER DIAGRAM NOTES

1. FOR FIRE ALARM EQUIPMENT SPECIFICATION AND ADDITIONAL REQUIREMENTS, SEE SPECIFICATIONS.
2. ALL DUCT DETECTORS SHALL BE WIRED TO ACTIVATE THE ALARM SYSTEM AND SHUT DOWN FAN. PROVIDE INDICATOR LIGHT WHERE SMOKE DETECTORS ARE INSTALLED IN CONCEALED LOCATIONS OR ARE MORE THAN 10FT. ABOVE THE FINISHED FLOOR.
3. CANDELA RATING ARE SHOWN IN ALL ROOMS. ALL AUDIO AND VISUAL RATINGS SHALL MEET OR EXCEED NFPA REQUIREMENTS. MINOR DEVIATIONS SUCH AS STROBE RATING, MISSING OF AUDIO/VISUAL UNITS, SMOKE DETECTORS UNITS, ETC. (MAX OF 10) SHALL BE INCLUDED.
4. PROVIDE REMOTE POWER SUPPLIES AS REQUIRED FOR NOTIFICATION APPLIANCE CIRCUITS, NOT TO EXCEED 80% OF CAPACITY.
5. PROVIDE SMOKE DETECTOR ABOVE EACH REMOTE POWER SUPPLY PANEL.
6. PROVIDE BATTERY, CURRENT LOAD AND VOLTAGE DROP CALCULATIONS PER SPECIFICATIONS.
7. SEAL AROUND ALL PIPES & CONDUITS IN MASONRY AND DRYWALL WALLS.
8. ALL FIRE ALARM WIRING SHALL BE MINIMUM #4 AWG AND IN CONDUIT MIN 3/4 " IN EXPOSED CEILING AREAS, CABLE IS ACCEPTABLE ABOVE LAY-IN CEILING IN J-HOOKS.
9. FIRE ALARM CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CHARGES INVOLVED IN OBTAINING APPROVAL AND CERTIFICATION FROM STATE ELECTRICAL INSPECTOR FOR A COMPLETE SYSTEM. CERTIFIED CONTRACTOR TO PAY ALL FEES REQUIRED.
10. THE ELEVATION DIAGRAM IS FOR REFERENCE PURPOSES. EXACT QUANTITIES OF DEVICES AND LOCATIONS SHALL COMPLY WITH NFPA GUIDELINES AND MEET APPROVAL OF THE STATE ELECTRICAL INSPECTOR. FIRE ALARM CONTRACTOR SHALL HAVE SHOP DRAWINGS APPROVED BY THE STATE ELECTRICAL INSPECTOR PRIOR TO COMMENCEMENT OF WORK.
11. FOR FIRE ALARM SYMBOL LEGEND SEE DRAWING E0.00.
12 ALL PULL STATIONS ARE TO BE LOCATED IN THE SECURE SIDE OF THE VESTIBULE WITHIN 5' OF ALL EXTERIOR DOORS
13 PROVIDE REQUIRED RELAYS FOR AUDIO SILENCING UPON FIRE ALARM ACTIVATION TIE-INS FOR GYM AND CAFETERIA SOUND SYSTEMS.

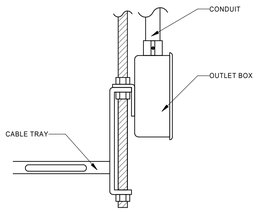
NOTE:
REFER TO PLANS FOR LOCATION OF SIGNAL DEVICES.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

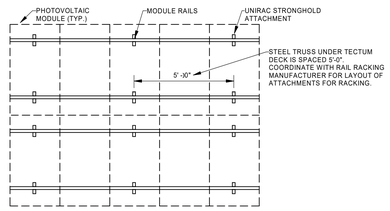
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915



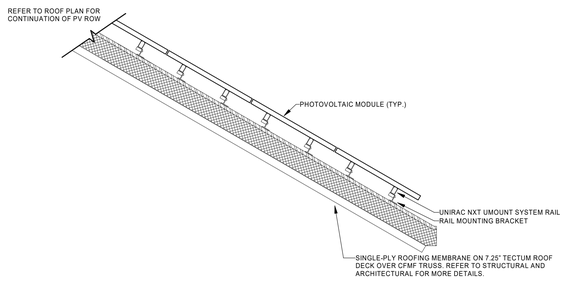
HANDHOLE DETAIL
NO SCALE



OUTLET BOX MOUNTED TO CABLETRAY
NO SCALE



TOP VIEW
NO SCALE



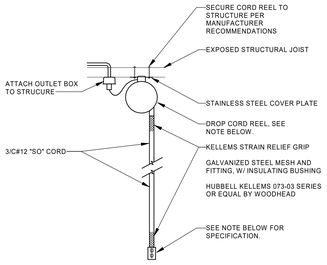
NOTES

INSTALL WIRE MANAGEMENT AND GROUNDING PER MANUFACTURERS DETAILS AND RECOMMENDATIONS.

COORDINATE WITH MANUFACTURER OF BOTH TECTUM ROOF DECK AND PV RACKING FOR RECOMMENDATIONS OF ADDITIONAL RAILS AND CONNECTIONS REQUIRED DUE TO THICKNESS OF TECTUM ROOF DECK. TYPICAL LAG BOLT SUPPLIED BY UNIRAC FOR THE NXT UMOUNT SYSTEM IS 3 3/8". TO PENETRATE PAST THE 7 1/4" TECTUM ROOF DECK THE TYPICAL LAG BOLT WILL NOT BE USED AND A LAG BOLT OF AT LEAST 9" MINIMUM IS TO BE USED TO PENETRATE INTO THE STEEL TRUSS UNDER THE TECTUM DECK. UNIRAC TECHNICAL SUPPORT: 319-855-1480. TECTUM TECHNICAL SUPPORT: 740-364-8196.

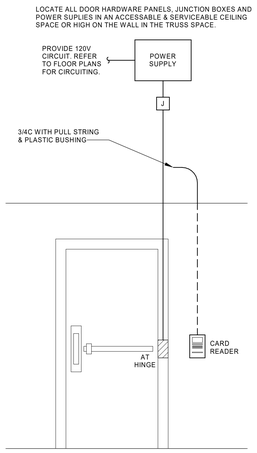
SECTION VIEW
NO SCALE

SLOPED ROOF PV RAIL RACKING
NO SCALE

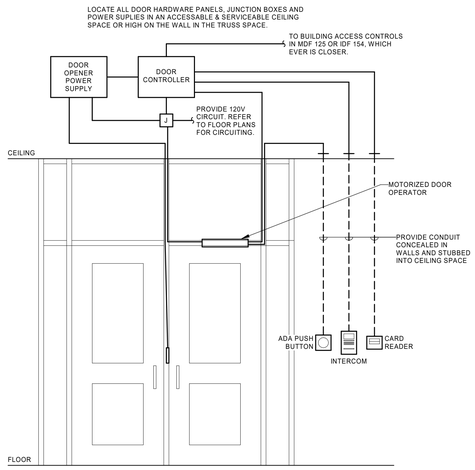


NOTES:
1. CORD REEL SHALL BE HUBBLE MODEL HBL25123R220 OR EQUAL
2. REFER TO POWER PLANS FOR CIRCUITING AND PANEL SCHEDULES FOR GFCI CIRCUIT BREAKERS.
3. CORD REELS TO BE MOUNTED TO SUPPORT BAR SECURED TO UNDER SIDE OF STRUCTURE IN CEILING SPACE. COORDINATE WITH STRUCUTURAL AND CORD REEL MANUFACTUER FOR INSTALLATION AND ASSEMBLY COMPONENTS. UNISTRUT TO BE PAINTED AS REQUIRED TO MATCH STRUCTURE.

DROP CORD RECEPTACLE DETAIL
NO SCALE



DOOR CARD READER
NO SCALE



REFER TO TECHNOLOGY, SECURITY AND LOW VOLTAGE DRAWINGS FOR ADDITIONAL INFORMATION.

TYPICALL DOOR ACCESS CONTROL DETAIL
NO SCALE

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201000204
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
ELECTRICAL DETAILS

SHEET NO.
E5.1

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PLEASE RECYCLE

PANEL NAME: SH1

PANEL LOCATION: EM. ELEC 120B | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: MLO | BUSSING: 600 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 65,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				10940	34364								2
3	T-S1	40 A	3			8556	34364			3	150 A	RTU-DOAS-100 - ROOF	4
5								8315	34364				6
7				18567	13912								8
9	RTU-136 - ROOF	90 A	3			18567	13912			3	70 A	RTU-136 - HEATER - ROOF	10
11								18567	13912				12
13				25219	17404								14
15	RTU-156 - ROOF	110 A	3			25219	17404			3	80 A	RTU-156 HEATING - ROOF	16
17								25219	17404				18
19	SPARE	20 A	1	0	0					1	20 A	SPARE	20
21	SPARE	20 A	1			0	0			1	20 A	SPARE	22
23	SPACE	--	1					--	--	1	--	SPACE	24
25	SPACE	--	1	--	--					1	--	SPACE	26
27	SPACE	--	1			--	--			1	--	SPACE	28
29	SPACE	--	1					--	--	1	--	SPACE	30
31	SPACE	--	1	--	--					1	--	SPACE	32
33	SPACE	--	1			--	--			1	--	SPACE	34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
			TOTAL LOAD:	120405 VA		118021 VA		117780 VA					
			TOTAL AMP:	435 A		426 A		425 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	234449 VA	100.00%	234449 VA		
HEATING	93946 VA	100.00%	93946 VA	CONNECTED LOAD:	356 kVA
Motor	2870 VA	114.49%	3286 VA	DEMAND LOAD:	357 kVA
RECEPTACLE	8644 VA	100.00%	8644 VA	TOTAL CONNECTED:	428 A
POWER	13897 VA	100.00%	13897 VA	TOTAL DEMAND:	430 A
LIGHTING	2400 VA	125.00%	3000 VA		

NOTES:

PANEL NAME: EH1

PANEL LOCATION: EM. ELEC 120B | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: MLO | BUSSING: 100 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 35,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	EM LTG - UNIT 100 - NORTHWEST	20 A	1	0	0					1	20 A	EM LTG - UNIT 100 - NORTHEAST	2
3	EM LTG - UNIT 100 - SOUTHWEST	20 A	1			0	0			1	20 A	EM LTG - UNIT 100 - SOUTHEAST	4
5	SPARE	20 A	1					0	0	1	20 A	SPARE	6
7	SPARE	20 A	1	0	0					1	20 A	SPARE	8
9	SPACE	--	1			--	--			1	--	SPACE	10
11	SPACE	--	1					--	--	1	--	SPACE	12
13	SPACE	--	1	--	--					1	--	SPACE	14
15	SPACE	--	1			--	--			1	--	SPACE	16
17	SPACE	--	1					--	--	1	--	SPACE	18
19	SPACE	--	1	--	--					1	--	SPACE	20
21	SPACE	--	1			--	--			1	--	SPACE	22
23	SPACE	--	1					--	--	1	--	SPACE	24
25	SPACE	--	1	--	--					1	--	SPACE	26
27	SPACE	--	1			--	--			1	--	SPACE	28
29	SPACE	--	1					--	--	1	--	SPACE	30
31	SPACE	--	1	--	--					1	--	SPACE	32
33	SPACE	--	1			--	--			1	--	SPACE	34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
			TOTAL LOAD:	0 VA		0 VA		0 VA					
			TOTAL AMP:	0 A		0 A		0 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
				CONNECTED LOAD:	0 kVA
				DEMAND LOAD:	0 kVA
				TOTAL CONNECTED:	0 A
				TOTAL DEMAND:	0 A

NOTES:
LIGHTING LOAD FOR "EM LTG" AND "LTG GTD" IS SHOWN ON NORMAL POWER CIRCUITS SO THE LOAD IS NOT COUNTED TWICE ON THE BUILDING SERVICE.
PROVIDE WITH SURGE PROTECTION.

PANEL NAME: MSB

PANEL LOCATION: ELECT. 121 | ENCLOSURE: TYPE 1 | MOUNTING: FLOOR
MAIN: 2500 A | BUSSING: 2500 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 80,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				11744	61609								2
3	MH1A	100 A	3			8340	57211			3	800 A	MH2	4
5								7621	55818				6
7				52751	60449								8
9	MH1B	200 A	3			52751	56256			3	600 A	MH4	10
11								52751	62437				12
13				33013	59183								14
15	MH1C	200 A	3			28287	53996			3	600 A	MH3	16
17								28225	59478				18
19				37053	51456								20
21	T-K	150 A	3			32564	42060			3	200 A	T-1A	22
23								30116	40424				24
25				120405	0								26
27	ATS-S	600 A	3			118021	0			3	100 A	ATS-E	28
29								117780	0				30
31				--	--								32
33	SPACE	--	3			--	--			3	--	SPACE	34
35								--	--				36
37				--	--								38
39	SPACE	--	3			--	--			3	--	SPACE	40
41								--	--				42
			TOTAL LOAD:	487663 VA		449486 VA		454650 VA					
			TOTAL AMP:	1763 A		1623 A		1644 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	585709 VA	100.00%	585709 VA		
HEATING	310435 VA	100.00%	310435 VA	CONNECTED LOAD:	1392 kVA
KITCHEN EQUIPMENT - NON-DWELLING UNIT	138113 VA	65.00%	89774 VA	DEMAND LOAD:	1300 kVA
Motor	141588 VA	103.08%	145953 VA	TOTAL CONNECTED:	1674 A
RECEPTACLE	126384 VA	53.96%	68192 VA	TOTAL DEMAND:	1563 A
POWER	48953 VA	100.00%	48953 VA		
LIGHTING	40616 VA	125.00%	50770 VA		

NOTES:
PROVIDE WITH SURGE PROTECTION DEVICE.

PANEL NAME: MH1C

PANEL LOCATION: IDF 138 | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: MLO | BUSSING: 250 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 14,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				9561	4767								2
3	ECUH-D - VEST 101	20 A	3			9561	4767			3	20 A	ECUH-B - VEST 102	4
5								9561	4767				6
7				2106	1526								8
9	HP-F-151- STOR 153	15 A	3			2106	1526			3	15 A	HP-E-155 - STOR 153	10
11								2106	1526				12
13				2716	2716								14
15	HP-I-147 - CORRIDOR 103	15 A	3			2716	2716			3	15 A	HP-I-145 - ART STOR. 133A	16
17								2716	2716				18
19				2716	1472					1	20 A	LTG - RMS 140-145	20
21	HP-I-141 - ART STOR. 133A	15 A	3			2716	1423			1	20 A	LTG - VEST 100, 101, CORR 103, 104, 105	22
23								2716	2118	1	20 A	LTG - RMS 136 - 139	24
25	LTG - GYMNASIUM 156	20 A	1	3055	2379					1	20 A	LTG - RMS 146 - 155, 157 - 164	26
27	LTG - EXTERIOR EGRESS AND FACADE	20 A	1			757	0			1	20 A	SPARE	28
29	SPARE	20 A	1					0	0	1	20 A	SPARE	30
31	SPARE	20 A	1	0	--					1	--	SPACE	32
33	SPACE	--	1			--	--			1	--	SPACE	34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
			TOTAL LOAD:	33013 VA		28287 VA		28225 VA					
			TOTAL AMP:	119 A		102 A		102 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	35339 VA	100.00%	35339 VA		
HEATING	42982 VA	100.00%	42982 VA	CONNECTED LOAD:	90 kVA
LIGHTING	11204 VA	125.00%	14005 VA	DEMAND LOAD:	92 kVA
				TOTAL CONNECTED:	108 A
				TOTAL DEMAND:	111 A

NOTES:

PANEL NAME: MH1B

PANEL LOCATION: MDF 125 | ENCLOSURE: TYPE 1 | MOUNTING: RECESSED
MAIN: MLO | BUSSING: 250 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 22,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				9561	2716								2
3	ECUH-D - VEST 100	20 A	3			9561	2716			3	15 A	HP-I-139 - STORAGE 137	4
5								9561	2716				6
7				3880	3880								8
9	GHXP-101 - MECHANICAL 124	25 A	3			3880	3880			3	25 A	GHXP-102 - MECHANICAL 124	10
11								3880	3880				12
13				5820	5820								14
15	GHXP-103 - MECHANICAL 124	40 A	3			5820	5820			3	40 A	GHXP-104 - MECHANICAL 124	16
17								5820	5820				18
19				2716	2924								20
21	HP-I-135 - SERVERY 135	15 A	3			2716	2924			3	15 A	HP-K-132 - DRY STORAG 133	22
23								2716	2924				24
25				11085	4351								26
27	DISHWASHER - KITCHEN 132	50 A	3			11085	4351			3	20 A	BLOW DRYER - KITCHEN 132	28
29								11085	4351				30
31	SPARE	20 A	1	0	0					1	20 A	SPARE	32
33	SPARE	20 A	1			0	0			1	20 A	SPARE	34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
			TOTAL LOAD:	52751 VA		52751 VA		52751 VA					
			TOTAL AMP:	190 A		190 A		190 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	25066 VA	100.00%	25066 VA		
HEATING	28683 VA	100.00%	28683 VA	CONNECTED LOAD:	158 kVA
KITCHEN EQUIPMENT - NON-DWELLING UNIT	46308 VA	100.00%	46308 VA	DEMAND LOAD:	163 kVA
Motor	58197 VA	107.50%	62561 VA	TOTAL CONNECTED:	190 A
				TOTAL DEMAND:	196 A

NOTES:

PANEL NAME: MH1A

PANEL LOCATION: ELECT. 121 | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: MLO | BUSSING: 125 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 65,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				3436	1524								2
3	EUH-B - RECEIVING 123	20 A	3			3436	1524			3	15 A	HP-E-116 - OFFICE SUPPORT 117	4
5								3436	1524				6
7				1524	1136								8
9	HP-E-108 - CLINIC 110	15 A	3			1524	1136			3	15 A	MAU-100 - ROOF	10
11								1524	1136				12
13	LTG - UNIT 100 - RMS 108-123	20 A	1	1861	2262					1	20 A	LTG - UNIT 100 - RMS 124-135	14
15	LTG - EXTERIOR EGRESS, FRONT CANOPY, FACADE	20 A	1			709	10			1	20 A	LTG - EXTERIOR FLAG POLE	16
17	SPARE	20 A	1					0	0	1	20 A	SPARE	18
19	SPARE	20 A	1	0	--					1	--	SPACE	20
21	SPACE	--	1			--	--			1	--	SPACE	22
23	SPACE	--	1					--	--	1	--	SPACE	24
25	SPACE	--	1	--	--					1	--	SPACE	26
27	SPACE	--	1			--	--			1	--	SPACE	28
29	SPACE	--	1					--	--	1	--	SPACE	30
31	SPACE	--	1	--	--					1	--	SPACE	32
33	SPACE	--	1			--	--			1	--	SPACE	34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
			TOTAL LOAD:	11744 VA		8340 VA		7621 VA					
			TOTAL AMP:	43 A		31 A		28 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	12554 VA	100.00%	12554 VA		
HEATING	10309 VA	100.00%	10309 VA	CONNECTED LOAD:	28 kVA
LIGHTING	4842 VA	125.00%	6052 VA	DEMAND LOAD:	29 kVA
				TOTAL CONNECTED:	33 A
				TOTAL DEMAND:	35 A

NOTES:

PANEL NAME: MH4

PANEL LOCATION: MECH 410A | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: 600 A | BUSSING: 600 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 22,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				10037	4767								2
3	T-4	90 A	3			6343	4767			3	20 A	ECUH-B - VEST 400	4
5								12696	4767				6
7				4767	4434								8
9	ECUH-B - CORRIDOR 402	25 A	3			4767	4434			3	20 A	VUV-A-411 - CLASSROOM 411	10
11								4767	4434				12
13				4434	4434								14
15	VUV-A-412 - CLASSROOM 412	20 A	3			4434	4434			3	20 A	VUV-A-413 - CLASSROOM 413	16
17								4434	4434				18
19				4434	4434								20
21	VUV-A-414 - CLASSROOM 414	20 A	3			4434	4434			3	20 A	VUV-A-415 - CLASSROOM 415	22
23								4434	4434				24
25				4434	1580								26
27	VUV-A-416 - CLASSROOM 416	20 A	3			4434	1580			3	15 A	HP-I-401 - CORRIDOR 402	28
29								4434	1580				30
31				1330	1330								32
33	GHXP-401 - MECH 405	15 A	3			1330	1330			3	15 A	GHXP-402 - MECH 405	34
35								1330	1330				36
37				2106	2106								38
39	GHXP-403 - MECH 405	15 A	3			2106	2106			3	15 A	GHXP-404 - MECH 405	40
41								2106	2106				42
43				3667	1656					1	20 A	LTG - UNIT 400 - CLASSROOMS 412, 414, 416	44
45	ETC-HP-401 - CORRIDOR 402	20 A	3			3667	1656			1	20 A	LTG - UNIT 400 - CLASSROOMS 411, 413, 415	46
47								3667	1485	1	20 A	LTG - UNIT 400 - RMS 400, 401, 402, 403 - 410	48
49	LTG - UNIT 400 - EXTERIOR S1, S2, S6	20 A	1	499	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	0			1	20 A	SPARE	52
53	SPARE	20 A	1					0	0	1	20 A	SPARE	54
55	SPARE	20 A	1	0	0					1	20 A	SPARE	56
57	SPARE	20 A	1			0	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79				0	--					1	--	SPACE	80
81	PV4 - PV ARRAY 4	100 A	3			0	--			1	--	SPACE	82
83								0	--	1	--	SPACE	84
			TOTAL LOAD:	60449 VA		56256 VA		62437 VA					
			TOTAL AMP:	221 A		203 A		228 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	87151 VA	100.00%	87151 VA		
HEATING	39599 VA	100.00%	39599 VA	CONNECTED LOAD:	179 kVA
Motor	23745 VA	106.65%	25324 VA	DEMAND LOAD:	179 kVA
RECEPTACLE	16920 VA	79.55%	13460 VA	TOTAL CONNECTED:	215 A
POWER	5180 VA	100.00%	5180 VA	TOTAL DEMAND:	215 A
LIGHTING	6546 VA	125.00%	8182 VA		

NOTES:
PROVIDE WITH SERVICE ENTRANCE RATED MAIN BREAKER.

PANEL NAME: MH3

PANEL LOCATION: MECH 310A | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: 600 A | BUSSING: 600 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 22,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				10000	4767								2
3	T-3	90 A	3			5317	4767			3	25 A	ECUH-B - VEST 300	4
5								10973	4767				6
7				4767	4434								8
9	ECUH-B - CORRIDOR 302	25 A	3			4767	4434			3	20 A	VUV-5-303 - CLASSROOM 303	10
11								4767	4434				12
13				4434	4434								14
15	VUV-5-304 - CLASSROOM 304	20 A	3			4434	4434			3	20 A	VUV-5-305 - CLASSROOM 305	16
17								4434	4434				18
19				4434	4434								20
21	VUVA-306 - CLASSROOM 306	20 A	3			4434	4434			3	20 A	VUV-A-307 - CLASSROOM 307	22
23								4434	4434				24
25				4434	1580								26
27	VUV-A-308 - CLASSROOM 308	20 A	3			4434	1580			3	15 A	HP-G-301 - STOR 310	28
29								4434	1580				30
31				1330	1330								32
33	GHXP-301 - MECH 311	15 A	3			1330	1330			3	15 A	GHXP-302 - MECH 311	34
35								1330	1330				36
37				2106	2106								38
39	GHXP-303 - MECH 311	15 A	3			2106	2106			3	15 A	GHXP-304 - MECH 311	40
41								2106	2106				42
43				2433	1656					1	20 A	LTG - UNIT 300 - CLASSROOMS 304, 306, 308	44
45	ETC-HP-301 - STOR. 310	20 A	3			2433	1656			1	20 A	LTG - UNIT 300 - CLASSROOMS 303, 305, 307	46
47								2433	1482	1	20 A	LTG - UNIT 300 - RMS 300, 301, 302, 309 - 315	48
49	LTG - UNIT 300 - EXTERIOR S1, S2, S6	20 A	1	504	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	0			1	20 A	SPARE	52
53	SPARE	20 A	1					0	0	1	20 A	SPARE	54
55	SPARE	20 A	1	0	0					1	20 A	SPARE	56
57	SPARE	20 A	1			0	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79				0	--					1	--	SPACE	80
81	PV3 - PV ARRAY 3	100 A	3			0	--			1	--	SPACE	82
83								0	--	1	--	SPACE	84
			TOTAL LOAD:	59183 VA		53996 VA		59478 VA					
			TOTAL AMP:	217 A		195 A		218 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	87151 VA	100.00%	87151 VA		
HEATING	35899 VA	100.00%	35899 VA	CONNECTED LOAD:	173 kVA
Motor	22089 VA	107.15%	23668 VA	DEMAND LOAD:	173 kVA
RECEPTACLE	15480 VA	82.30%	12740 VA	TOTAL CONNECTED:	208 A
POWER	5290 VA	100.00%	5290 VA	TOTAL DEMAND:	208 A
LIGHTING	6748 VA	125.00%	8435 VA		

NOTES:
PROVIDE WITH SERVICE ENTRANCE RATED MAIN BREAKER.

PANEL NAME: MH2

PANEL LOCATION: MECH 210 | ENCLOSURE: TYPE 1 | MOUNTING: SURFACE
MAIN: 800 A | BUSSING: 800 A | GROUND BUS: STANDARD | NEUTRAL: 100.00%
VOLTAGE: 277/480 Wye | PHASE: 3 | WIRE: 4 | MIN A.I.C. RATING: 30,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				11932	4767								2
3	T-2	90 A	3			8288	4767			3	25 A	ECUH-B - VEST 200	4
5								6336	4767				6
7				4767	4434								8
9	ECUH-B - VEST 201	25 A	3			4767	4434			3	20 A	VUV-A-202 - CLASSROOM 202	10
11								4767	4434				12
13				4434	4434								14
15	VUV-A-205 - CLASSROOM 205	20 A	3			4434	4434			3	20 A	VUV-A-208 - CLASSROOM 208	16
17								4434	4434				18
19				4434	4434								20
21	VUV-A-211 - CLASSROOM 211	20 A	3			4434	4434			3	20 A	VUV-A-214 - CLASSROOM 214	22
23								4434	4434				24
25				4434	2106								26
27	VUV-A-217 - CLASSROOM 217	20 A	3			4434	2106			3	15 A	HP-F-201 - CORRIDOR 201	28
29								4434	2106				30
31				1330	1330								32
33	GHXP-201 - MECH 222	15 A	3			1330	1330			3	15 A	GHXP-202 - MECH 222	34
35								1330	1330				36
37				2106	2106								38
39	GHXP-203 - MECH 222	15 A	3			2106	2106			3	15 A	GHXP-204 - MECH 222	40
41								2106	2106				42
43				2433	1950					1	20 A	LTG - UNIT 200 - CLASSROOMS 205, 211, 217	44
45	ETC-HP-201 - CORRIDOR 201	20 A	3			2433	1373			1	20 A	LTG - UNIT 200 - RMS 200, 201, 203	46
47								2433	1932	1	20 A	LTG - UNIT 200 - CLASSROOMS 202, 208, 214	48
49	LTG - UNIT 200 - EXTERIOR S1, S2, S6	20 A	1	178	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	0			1	20 A	SPARE	52
53	SPARE	20 A	1					0	0	1	20 A	SPARE	54
55	SPARE	20 A	1	0	0					1	20 A	SPARE	56
57	SPARE	20 A	1			0	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79				0	--					1	--	SPACE	80
81	PV2 - PV ARRAY 2	150 A	3			0	--			1	--	SPACE	82
83								0	--	1	--	SPACE	84
			TOTAL LOAD:	61609 VA		57211 VA		55818 VA					
			TOTAL AMP:	223 A		207 A		202 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	88731 VA	100.00%	88731 VA		
HEATING	35899 VA	100.00%	35899 VA	CONNECTED LOAD:	175 kVA
Motor	24194 VA	106.53%	25774 VA	DEMAND LOAD:	175 kVA
RECEPTACLE	16200 VA	80.86%	13100 VA	TOTAL CONNECTED:	210 A
POWER	2930 VA	100.00%	2930 VA	TOTAL DEMAND:	210 A
LIGHTING	6683 VA	125.00%	8354 VA		

NOTES:
PROVIDE WITH SERVICE ENTRANCE RATED MAIN BREAKER.

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050400
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PANEL SCHEDULES - 480/277V PANELS

SHEET NO.
E6.0

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PLEASE RECYCLE

PANEL NAME: HR1C

PANEL LOCATION:	IDF 138	**MAIN:**	MLO	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	225 A	**PHASE:**	3
MOUNTING:	SURFACE	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - NORTH GENERAL USE - GYM 156	20 A	1	720	720					1	20 A	REC - SOUTH GENERAL USE - GYM 156	2
3	REC - WEST SCOREBOARD - GYM 156	20 A	1			180	180			1	20 A	REC - EAST SCOREBOARD - GYM 156	4
5	REC - MAIN COURT BACKBOARD MOTOR - GYM 156	20 A	1					1380	1380	1	20 A	REC - MAIN COURT BACKBOARD MOTOR - GYM 156	6
7	REC - SIDE COURT BACKBOARD MOTOR - GYM 156	20 A	1	1380	1380					1	20 A	REC - SIDE COURT BACKBOARD MOTOR - GYM 156	8
9	REC - SIDE COURT BACKBOARD MOTOR - GYM 156	20 A	1			1380	1380			1	20 A	REC - SIDE COURT BACKBOARD MOTOR - GYM 156	10
11	FLOORBOXES - GYM156	20 A	1					720	180	1	20 A	REC - DRINKING FOUNTAIN - GYM 156	12
13				1057	1176					1	20 A	FOLD-UP DIVIDER POWER/CONTROLLER - GYM 156	14
15	FOLDING BLEACHERS - GYM 156	30 A	3			1057	720			1	20 A	REC - FAMILY 155	16
17								1057	180	1	20 A	REC - FAMILY SHOWER 152	18
19	REC - WASHER - FAMILY 155	20 A	1	1000	180					1	20 A	REC - REFRIGERATOR - FAMILY 155	20
21	REC - DRYER - FAMILY 155	30 A	2			2200	180			1	20 A	REC - MICROWAVE UPPER CABINETS - FAMILY 155	22
23								2200	360	1	20 A	REC - ABOVE COUNTER - FAMILY	24
25	REC - FAMILY 155	20 A	1	720	360					1	20 A	REC - STOR 153, IDF 154	26
27	REC - TEACHING WALL - STEAM/COMM 151	20 A	1			900	900			1	20 A	REC - STEAM/COMM 151	28
29	REC - CHARGING STATION - STEAM/COMM 151	20 A	1					180	540	1	20 A	REC - ABOVE COUNTER - STEAM/COMM 151	30
31	(GFCI) REC - CORD REEL - STEAM/COMM 151	20 A	1	1080	1080					1	20 A	REC - IT STAFF 148, 149	32
33	REC - IT STAFF 149, 150	20 A	1			1080	900			1	20 A	REC - TEACHING WALL - RESOURCE 147	34
35	REC - RESOURCE 147	20 A	1					900	180	1	20 A	REC - CHARGING STATION - RESOURCE 147	36
37	REC - SENSORY RM 146	20 A	1	720	1080					1	20 A	REC - CORRIDOR 103	38
39	REC - DRINKING FOUNTAIN - CORRIDOR 103	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM	40
41	REC - ABOVE COUNTER - CLASSROOM 145	20 A	1					720	1080	1	20 A	REC - TEACHING WALL - CLASSROOM	42
43	REC - CLASSROOM 145	20 A	1	900	1080					1	20 A	(GFCI) REC - CORD REEL - CLASSROOM	44
45	REC - ART STOR 143, SCI STOR 144	20 A	1			360	180			1	20 A	REC - CHARGING STATION - ART 141	46
47	REC - ABOVE COUNTER - ART 141	20 A	1					540	1080	1	20 A	REC - TEACHING WALL - ART 141	48
49	REC - ART 141	20 A	1	900	1080					1	20 A	(GFCI) REC - CORD REEL - ART 141	50
51	REC - VENDING - TEACHER'S LOUNGE 140	20 A	1			180	540			1	20 A	REC - TEACHER'S LOUNGE 140	52
53	REC - COPIER/PRINTER - TEACHER'S LOUNGE 140	20 A	1					180	800	1	20 A	REC - REFRIGERATOR - TEACHER'S LOUNGE 140	54
55	REC - ABOVE COUNTER - TEACHER'S LOUNGE 140	20 A	1	360	1500					1	20 A	REC - MICROWAVE - TEACHER'S LOUNGE 140	56
57	REC - ROOF MAINTENANCE	20 A	1			540	1000						58
59								1000	1000	3	20 A	ETC-HP-145 - STORAGE 144	60
61	ETC-HP-141 - STORAGE 144	20 A	3	1000	1000								62
63						1000	1248			2	20 A	ACCU-102 - ROOF	64
65	REC - EXTERIOR - SOUTH, WEST	20 A	1					720	1248				66
67	REC - EXTERIOR PEDESTAL MOUNTED	20 A	1	360	1000					1	20 A	MONUMENT SIGN - ILLUMINATION - SOUTH	68
69	MONUMENT SIGN - WIRELESS RECEIVER - SOUTH	20 A	1			500	1071			2	15 A	HP-C-140 - CORRIDOR 103	70
71	HP-B-103 - CORRIDOR 104	20 A	2					603	1071				72
73				603	1000								74
75	(GFCI) REC - CORD REEL - STEAM/COMM 151	20 A	1			1080	1000			3	20 A	ETC-HP-140 - CORRIDOR 103	76
77	(GFCI) REC - CORD REEL - CLASSROOM	20 A	1					1080	1000				78
79	(GFCI) REC - CORD REEL - ART 141	20 A	1	1080	0					1	20 A	SPARE	80
81	SPARE	20 A	1			0	0			1	20 A	SPARE	82
83	SPARE	20 A	1					0	0	1	20 A	SPARE	84
			TOTAL LOAD:	24516 VA		20116 VA		21379 VA					
			TOTAL AMP:	206 A		168 A		180 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	5845 VA	100.00%	5845 VA		
HEATING	9000 VA	100.00%	9000 VA	**CONNECTED LOAD:**	66 kVA
Motor	3170 VA	106.25%	3369 VA	**DEMAND LOAD:**	53 kVA
RECEPTACLE	37040 VA	63.50%	23520 VA	**TOTAL CONNECTED:**	183 A
POWER	9956 VA	100.00%	9956 VA	**TOTAL DEMAND:**	147 A
LIGHTING	1000 VA	125.00%	1250 VA		

NOTES:

PANEL NAME: HR1B

PANEL LOCATION:	MDF 125	**MAIN:**	MLO	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	125 A	**PHASE:**	3
MOUNTING:	RECESSED	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - CORRIDOR 104, 107	20 A	1	1080	1080					1	20 A	REC - GENERAL USE 105, 106, 130, 131, 137, 138	2
3	REC - GENERAL USE - MECHANICAL 124	20 A	1			1080	60			1	20 A	AUTOMATIC FAUCET - MEN 126A, WOMENS 127	4
5	REC - DRINKING FOUNTAIN - CORRIDOR 104	20 A	1					180	540	1	20 A	REC - MEN 126A, STOR. 126B, WOMEN 127	6
7	REC - UNISEX128, STAFF 129	20 A	1	360	900					1	20 A	REC - MUSIC 139	8
9	REC - ABOVE COUNTER - MUSIC 139	20 A	1			360	1080			1	20 A	REC - TEACHING WALL - MUSIC 139	10
11	REC - CHARGING STATION - MUSIC 139	20 A	1					180	360	1	20 A	REC - CAFETERIA AV RACK - STORAGE	12
13	REC - DIGITAL DISPLAY MENU -CAFETERIA 136	20 A	1	180	1248					2	20 A	ACCU-100 - ROOF MAIN BUILDING	14
15	REC - DRINKING FOUNTAIN - CAFETERIA 136	20 A	1			180	1248						16
17	REC - GENERAL USE - CAFETERIA 136	20 A	1					1080	180	1	20 A	REC - CEILING PROJECTOR - CAFETERIA 139	18
19	REC - EXTERIOR - SOUTH	20 A	1	540	360					1	20 A	REC - CAFETERIA 136	20
21						1000	720			1	20 A	REC - OFFICE 164	22
23	ETC-HP-139 - STORAGE 137	20 A	3					1000	180	1	20 A	REC - SHOWER 161	24
25				1000	180					1	20 A	REC - SHOWER 160	26
27	MOTORIZED SHADES - CAFETERIA 136	20 A	1			200	1279			2	20 A	EUH-C - STORAGE 157	28
29	GMU-100 - MECH 124	25 A	1					1656	1279				30
31	REC - CHANGING 158, 159, 163, STORAGE 157	20 A	1	900	603					2	15 A	HP-B-104 - CORRIDOR 104	32
33	REC - CHANGING SHOWER 162	20 A	1			180	603						34
35	REC - AV CABINET - STORAGE 157	20 A	1					360	540	1	20 A	REC - CAFETERIA PROJ. WALL - CAFETERIA 136	36
37	SPARE	20 A	1	0	0					1	20 A	SPARE	38
39	SPARE	20 A	1			0	0			1	20 A	SPARE	40
41	SPARE	20 A	1					0	0	1	20 A	SPARE	42
43	SPARE	20 A	1	0	0					1	20 A	SPARE	44
45	SPACE	--	1			--	--			1	--	SPACE	46
47	SPACE	--	1					--	--	1	--	SPACE	48
49	SPACE	--	1	--	--					1	--	SPACE	50
51	SPACE	--	1			--	--			1	--	SPACE	52
53	SPACE	--	1					--	--	1	--	SPACE	54
55	SPACE	--	1	--	--					1	--	SPACE	56
57	SPACE	--	1			--	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
			TOTAL LOAD:	8431 VA		7990 VA		7535 VA					
			TOTAL AMP:	71 A		67 A		63 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	3702 VA	100.00%	3702 VA		
HEATING	5558 VA	100.00%	5558 VA	**CONNECTED LOAD:**	24 kVA
Motor	1676 VA	124.70%	2090 VA	**DEMAND LOAD:**	23 kVA
RECEPTACLE	12960 VA	88.58%	11480 VA	**TOTAL CONNECTED:**	66 A
POWER	60 VA	100.00%	60 VA	**TOTAL DEMAND:**	64 A

NOTES:

PANEL NAME: HR1A

PANEL LOCATION:	ELECT. 121	**MAIN:**	400 A	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	400 A	**PHASE:**	3
MOUNTING:	SURFACE	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				8431	24516								2
3	HR1B - IDF 124	125 A	3			7990	20116			3	225 A	HR1C - IDF 154	4
5								7535	21379				6
7				1440	2000					2	25 A	DWH-102 - BOILER/MECH 120	8
9	HR5 - EXTERIOR STORAGE BUILDING	50 A	3			194	2000						10
11								0	510	2	20 A	P-DWH-102 - BOILER/MECH 120	12
13	REC - PRINCIPAL 114	20 A	1	900	510								14
15	REC - OFFICE 118	20 A	1			720	1300			2	20 A	ACCU-101 - ROOF	16
17	REC - SECURITY 115	20 A	1					720	1300				18
19	REC - CHECK-IN COMPUTER - WELCOME 108	20 A	1	180	2000					2	25 A	DWH-103 - BOILER/MECH 120	20
21	REC - GENERAL USE - CONFERENCE 116	20 A	1			720	2000						22
23	REC - GENERAL USE - CONFERENCE 116	20 A	1					900	1000				24
25	FLOORBOXES, REC - CONFERENCE 116	20 A	1	900	1000					3	20 A	ETC-HP-114 - STORAGE 119	26
27	REC - ABOVE COUNTER - CONFERENCE 116	20 A	1			360	1000						28
29	REC - OFFICE SUPPORT 117	20 A	1					360	520	2	15 A	HP-A-114 - STORAGE 119	30
31	REC - ABOVE COUNTER - OFFICE SUPPORT 117	20 A	1	540	520								32
33	REC - REFRIGERATOR - OFFICE SUPPORT 117	20 A	1			180	1000						34
35	REC - COPY/PRINTER - OFFICE SUPPORT 117	20 A	1					180	1000	3	20 A	ETC-HP-108 - CLINC 110	36
37	REC - REFRIGERATOR, GENERAL USE - CLINIC 110	20 A	1	720	1000								38
39	REC - GENERAL USE - 120, 120B, 121	20 A	1			900	520			2	15 A	HP-A-117 - STORAGE 119	40
41	REC - DISPLAY - WELCOME 108	20 A	1					360	520				42
43	REC - DESK WELCOME 108	20 A	1	360	1279					2	20 A	EUH-C - BOILER/MECH 120	44
45	REC - OFFICE SUPPORT 117	20 A	1			360	1279						46
47	REC - COFFEE BAR, GENERAL USE 108, 109	20 A	1					1080	520	2	15 A	HP-A-126 - STORAGE 131	48
49	REC - TOILET 111, TOILET 112	20 A	1	360	520								50
51	REC - COMPUTER - RECEIVING 123	20 A	1			360	600			1	20 A	P-DWH-101 - BOILER/MECH 120	52
53	REC - RECEIVING 123	20 A	1					720	500	1	15 A	DWH-101 - BOILER/MECH 120	54
55	REC - SUPPORT 113, STORAGE 119	20 A	1	900	500					1	20 A	MONUMENT SIGN - WIRELESS RECEIVER - SOUTH	56
57	REC - ROOF MAINTENANCE	20 A	1			540	1000			1	20 A	MONUMENT SIGN - ILLUMINATION - NORTH	58
59	GENERATOR BATTERY CHARGER	20 A	1					1200	1200	1	20 A	GENERATOR BLOCK HEATER	60
61	REC - EXTERIOR SERVICE YARD, NORTH FACADE	20 A	1	720	0					1	20 A	SPARE	62
63	SPARE	20 A	1			0	0			1	20 A	SPARE	64
65	SPARE	20 A	1					0	0	1	20 A	SPARE	66
67	SPARE	20 A	1	0	0					1	20 A	SPARE	68
69	SPARE	20 A	1			0	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
			TOTAL LOAD:	49296 VA		43140 VA		41504 VA					
			TOTAL AMP:	413 A		362 A		346 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	15267 VA	100.00%	15267 VA		
HEATING	23117 VA	100.00%	23117 VA	**CONNECTED LOAD:**	134 kVA
Motor	6966 VA	105.94%	7380 VA	**DEMAND LOAD:**	107 kVA
RECEPTACLE	65480 VA	57.64%	37740 VA	**TOTAL CONNECTED:**	372 A
POWER	20916 VA	100.00%	20916 VA	**TOTAL DEMAND:**	297 A
LIGHTING	2194 VA	125.00%	2743 VA		

NOTES:

PANEL NAME: HR4

PANEL LOCATION:	MECH 410A	**MAIN:**	225 A	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	225 A	**PHASE:**	3
MOUNTING:	SURFACE	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - TEACHING WALL - CLASSROOM 411	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 412	2
3	REC - CHARGING STATION - CLASSROOM 411	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 412	4
5	REC - CLASSROOM 411	20 A	1					900	900	1	20 A	REC - CLASSROOM 412	6
7	REC - TEACHING WALL - CLASSROOM 413	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 414	8
9	REC - CHARGING STATION - CLASSROOM 413	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 414	10
11	REC - CLASSROOM 413	20 A	1					900	900	1	20 A	REC - CLASSROOM 414	12
13	REC - TEACHING WALL - CLASSROOM 415	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 416	14
15	REC - CHARGING STATION - CLASSROOM 415	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 416	16
17	REC - CLASSROOM 415	20 A	1					900	900	1	20 A	REC - CLASSROOM 416	18
19	REC - GIRLS AND BOYS	20 A	1	360	180					1	20 A	REC - STAFF 408	20
21	REC - STAFF 407	20 A	1			180	60			1	20 A	AUTOMATIC FAUCETS - BOYS 400	22
23	REC - DRINKING FOUNTAIN - COLLAB CORR 401	20 A	1					180	900	1	20 A	REC - CORRIDOR, VEST 400	24
25	FACP - VESTIBULE 400	20 A	1	100	720					1	20 A	REC - PRINCIPAL 410	26
27	REC - MECH, STOR, JC 406	20 A	1			540	2000			2	25 A	DWH-400 - MECH 405	28
29	REC - CLG MT DISPLAY - MECH 405	20 A	1					180	2000				30
31	P-DWH-400 - MECH 405	15 A	1	264	360					1	20 A	REC - ROOF MAINTENANCE	32
33	ACCU-400 - ROOF	20 A	2			1300	360			1	20 A	REC - LV SERVER EQ - MECH 405	34
35								1300	180	1	20 A	REC - MECHANICAL CONTROLS	36
37	INTERCOM MASTER - PRINCIPAL 404	20 A	1	800	603					2	15 A	EF-400 - ROOF	38
39	DOOR LOCKS - 400 POD	20 A	1			220	603						40
41	GMU-400 - MECH 405	25 A	1					1656	900	1	20 A	REC - OFFICE 404	42
43	LIGHTING INVERTER - MECH 405	20 A	1	1250	0					1	20 A	SPARE	44
45	SPARE	20 A	1			0	0			1	20 A	SPARE	46
47	SPARE	20 A	1					0	0	1	20 A	SPARE	48
49	SPARE	20 A	1	0	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	--			1	--	SPACE	52
53	SPACE	--	1					--	--	1	--	SPACE	54
55	SPACE	--	1	--	--					1	--	SPACE	56
57	SPACE	--	1			--	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
			TOTAL LOAD:	10037 VA		6343 VA		12696 VA					
			TOTAL AMP:	88 A		53 A		111 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	2600 VA	100.00%	2600 VA		
Motor	3126 VA	113.24%	3540 VA	**CONNECTED LOAD:**	29 kVA
RECEPTACLE	16920 VA	79.55%	13460 VA	**DEMAND LOAD:**	26 kVA
POWER	5180 VA	100.00%	5180 VA	**TOTAL CONNECTED:**	81 A
LIGHTING	1250 VA	125.00%	1563 VA	**TOTAL DEMAND:**	73 A

NOTES:

PANEL NAME: HR3

PANEL LOCATION:	MECH 310A	**MAIN:**	225 A	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	225 A	**PHASE:**	3
MOUNTING:	SURFACE	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - TEACHING WALL - CLASSROOM 303	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 304	2
3	REC - CHARGING STATION - CLASSROOM 303	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 304	4
5	REC - CLASSROOM 303	20 A	1					900	900	1	20 A	REC - CLASSROOM 304	6
7	REC - TEACHING WALL - CLASSROOM 305	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 306	8
9	REC - CHARGING STATION - CLASSROOM 305	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 306	10
11	REC - CLASSROOM 305	20 A	1					900	900	1	20 A	REC - CLASSROOM 306	12
13	REC - TEACHING WALL - CLASSROOM 307	20 A	1	900	900					1	20 A	REC - TEACHING WALL - CLASSROOM 308	14
15	REC - CHARGING STATION - CLASSROOM 307	20 A	1			180	180			1	20 A	REC - CHARGING STATION - CLASSROOM 308	16
17	REC - CLASSROOM 307	20 A	1					900	900	1	20 A	REC - CLASSROOM 308	18
19	REC - BIRLS 314, BOYS 315	20 A	1	360	180					1	20 A	REC - STAF 312	20
21	REC - STAFF 313	20 A	1			180	60			1	20 A	AUTOMATIC FAUCETS - GIRLS 314, BOYS 315	22
23	REC - DRINKING FOUNTAIN - COLLAB CORR 301	20 A	1					180	900	1	20 A	REC - VESTIBULE 300, CORR. 301, 302	24
25	FACP - VESTIBULE 300	20 A	1	100	180					1	20 A	REC - CLG MT DISPLAY - MECH 311	26
27	REC - STOR, JC, MECH	20 A	1			720	264			1	15 A	P-DWH-300 - MECH 311	28
29	DWH-300 - MECH 311	25 A	2					2000	1300	2	20 A	ACCU-300 - ROOF 300	30
31				2000	1300								32
33	REC - ROOF MAINTENANCE	20 A	1			360	800			1	20 A	INTERCOM MASTER - MECH 311	34
35	REC - LV SERVER EQ - MECH 311	20 A	1					360	180	1	20 A	REC - MECHANICAL CONTROLS	36
37	AUTOMATIC DOOR ACTUATORS - VESTIBULE 300	20 A	1	230	200					1	20 A	LIGHTING	38
39	EF-300 - ROOF	15 A	2			603	1250			1	20 A	LIGHTING INVERTER - MECH 311	40
41								603	50	1	20 A	MOTORIZED DAMPERS	42
43	MOTORIZED DAMPERS	20 A	1	50	1000					1	20 A	REC - HOT BOX HEATER	44
45	REC - HOT BOX HEATER	20 A	1			1500	0			1	20 A	SPARE	46
47	SPARE	20 A	1					0	0	1	20 A	SPARE	48
49	SPARE	20 A	1	0	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	0			1	20 A	SPARE	52
53	SPARE	20 A	1					0	--	1	--	SPACE	54
55	SPACE	--	1	--	--					1	--	SPACE	56
57	SPACE	--	1			--	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
			TOTAL LOAD:	11000 VA		6817 VA		10973 VA					
			TOTAL AMP:	97 A		57 A		97 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	2600 VA	100.00%	2600 VA		
Motor	1470 VA	120.51%	1772 VA	**CONNECTED LOAD:**	29 kVA
RECEPTACLE	17980 VA	77.81%	13990 VA	**DEMAND LOAD:**	25 kVA
POWER	5290 VA	100.00%	5290 VA	**TOTAL CONNECTED:**	80 A
LIGHTING	1450 VA	125.00%	1813 VA	**TOTAL DEMAND:**	71 A

NOTES:

PANEL NAME: HR2

PANEL LOCATION:	MECH 210	**MAIN:**	225 A	**VOLTAGE:**	120/208 Wye
ENCLOSURE:	TYPE 1	**BUSSING:**	225 A	**PHASE:**	3
MOUNTING:	SURFACE	**GROUND BUS:**	STANDARD	**WIRE:**	4
		NEUTRAL:	100.00%	**MIN A.I.C. RATING:**	10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - TEACHING WALL - CLASSROOM 205	20 A	1	1080	1080					1	20 A	REC - TEACHING WALL - CLASSROOM 202	2
3	REC - ABOVE COUNTER - CLASSROOM 205	20 A	1			180	180			1	20 A	REC - ABOVE COUNTER - CLASSROOM 202	4
5	REC - CHARGING STATION - CLASSROOM 205	20 A	1					180	180	1	20 A	REC - CHARGING STATION - CLASSROOM 202	6
7	REC - CLASSROOM 205	20 A	1	720	720					1	20 A	REC - CLASSROOM 202	8
9	REC - TEACHING WALL - CLASSROOM 211	20 A	1			1080	1080			1	20 A	REC - TEACHING WALL - CLASSROOM 208	10
11	REC - ABOVE COUNTER - CLASSROOM 211	20 A	1					180	180	1	20 A	REC - ABOVE COUNTER - CLASSROOM 208	12
13	REC - CHARGING STATION - CLASSROM 211	20 A	1	180	180					1	20 A	REC - CHARGING STATION - CLASSROOM 208	14
15	REC - CLASSROOM 211	20 A	1			720	720			1	20 A	REC - CLASSROOM 208	16
17	INTERCOM MASTER - MECH 222	20 A	1					800	360	1	20 A	REC - LV SERVER EQ - MECH 210	18
19	REC - TEACHING WALL - CLASSROOM 217	20 A	1	1080	1080					1	20 A	REC - TEACHING WALL - CLASSROOM 214	20
21	REC - ABOVE COUNTER - CLASSROOM 217	20 A	1			180	180			1	20 A	REC - ABOVE COUNTER - CLASSROOM 214	22
23	REC - CHARGING STATION - CLASSROOM 217	20 A	1					180	180	1	20 A	REC - CHARGING STATION - CLASSROOM 214	24
25	REC - CLASSROOM 217	20 A	1	720	720					1	20 A	REC - CLASSROOM 214	26
27	REC - MECHANICAL CONTROLS	20 A	1			180	1250			1	20 A	LIGHTING INVERTER - MECH 222	28
29	REC - GENERAL USE - MECH 222, JC 221, STOR 223	20 A	1					1080	180	1	20 A	REC - STAFF 208	30
31	EF-220 - STAFF 220, EF-221 - JC 221	20 A	1	104	264					1	15 A	P-DWH-200- MECH 222	32
33	REC - DRINKING FOUNTAIN - CORRIDOR 201	20 A	1			180	180			1	20 A	REC - ROOF MAINTENANCE	34
35	REC - CORRIDOR 201	20 A	1					900	180	1	20 A	REC - CLG MT DISPLAY - MECH 222	36
37	ACCU-200 - ROOF 200	20 A	2	1300	828					2	20 A	DWH-200 - MECH 222	38
39						1300	828						40
41	FACP - VESTIBULE 200	20 A	1					100	1656	1	25 A	GMU-200 - MECH 222	42
43	GMU-300 - MECH 311	25 A	1	1656	220					1	20 A	AUTOMATIC DOOR ACTUATORS - VESTIBULE 200	44
45	MOTORIZED DAMPERS	20 A	1			50	0			1	20 A	SPARE	46
47	SPARE	20 A	1					0	0	1	20 A	SPARE	48
49	SPARE	20 A	1	0	0					1	20 A	SPARE	50
51	SPARE	20 A	1			0	0			1	20 A	SPARE	52
53	SPARE	20 A	1					0	--	1	--	SPACE	54
55	SPACE	--	1	--	--					1	--	SPACE	56
57	SPACE	--	1			--	--			1	--	SPACE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
			TOTAL LOAD:	11932 VA		8288 VA		6336 VA					
			TOTAL AMP:	102 A		72 A		53 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
HVAC	2600 VA	100.00%	2600 VA		
Motor	3576 VA	111.58%	3990 VA	**CONNECTED LOAD:**	27 kVA
RECEPTACLE	16200 VA	80.86%	13100 VA	**DEMAND LOAD:**	24 kVA
POWER	2930 VA	100.00%	2930 VA	**TOTAL CONNECTED:**	74 A
LIGHTING	1250 VA	125.00%	1563 VA	**TOTAL DEMAND:**	67 A

NOTES:

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANC	DAT
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

LSD SB-005
JOB 2616.01A

SHEET
PANEL SCHEDULES - 208/120V PANELS

SHEET
E6.1

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PANEL NAME: SR1

PANEL LOCATION: EM. ELEC 120B
ENCLOSURE: TYPE 1
MOUNTING: SURFACE
MAIN: 100 A
BUSSING: 125A
GROUND BUS: STANDARD
NEUTRAL: 100.00%
VOLTAGE: 120/208 Wye
PHASE: 3
WIRE: 4
MIN A.I.C. RATING: 10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1				1872	1200					1	20 A	WALK-IN FREEZER LTG, DOOR HEATER - 134	2
3	REC - RACK - MDF 125	20 A	2			1872	1885						4
5	REC - RACK - MDF 125	20 A	1					1000	1885	3	20 A	WALK-IN FREEZER CONDENSER - ROOF	6
7	REC - - MDF 125	20 A	1	1000	1885								8
9	REC - ACCESS CONTROLS - MDF 125	20 A	1			1000	946			2	20 A	WALK-IN FREEZER EVAPORATOR - WALK-INS 134	10
11	REC - ACCESS CONTROLS - MDF 125	20 A	1					1000	946				12
13	FIRE ALARM PANEL (FACP) - CORR. - 109	20 A	1	100	1200					1	20 A	WALK-IN COOLER LTG, DOOR HEATER - 134	14
15	GENERATOR ALARM PANEL (GAP) CORR. 111	20 A	1			100	1669						16
17	INTERCOM MASTER - WELCOME 108	20 A	1					500	1669	3	20 A	WALK-IN COOLER CONDENSER - ROOF	18
19	REC - RACK - IDF 154	20 A	1	360	1669								20
21	REC - ACCESS CONTROLS - IDF 154	20 A	1			360	120			1	20 A	WALK-IN COOLER EVAPORATOR - WALK-INS 134	22
23	REC - MECHANICAL CONTROLS - BOILER/MECH 120	20 A	1					180	832	2	20 A	KEF-101 - ROOF	24
25	AUTOMATIC DOOR ACTUATORS	20 A	1	520	832								26
27	SPARE	20 A	1			0	302			2	20 A	KEF-102 - ROOF	28
29	SPARE	20 A	1					0	302				30
31	SPARE	20 A	1	0	302					2	15 A	EF-100 - ROOF	32
33	SPARE	20 A	1			0	302						34
35	SPACE	--	1					--	--	1	--	SPACE	36
37	SPACE	--	1	--	--					1	--	SPACE	38
39	SPACE	--	1			--	--			1	--	SPACE	40
41	SPACE	--	1					--	--	1	--	SPACE	42
		TOTAL LOAD:		10940 VA		8556 VA		8315 VA					
		TOTAL AMP:		91 A		72 A		69 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
Motor	2870 VA	114.49%	3286 VA		
RECEPTACLE	8644 VA	100.00%	8644 VA	**CONNECTED LOAD:**	28 kVA
POWER	13897 VA	100.00%	13897 VA	**DEMAND LOAD:**	29 kVA
LIGHTING	2400 VA	125.00%	3000 VA	**TOTAL CONNECTED:**	77 A
				TOTAL DEMAND:	80 A

NOTES:

PANEL NAME: KR1

PANEL LOCATION: KITCHEN 132
ENCLOSURE: TYPE 1
MOUNTING: SURFACE
MAIN: 300 A
BUSSING: 400 A
GROUND BUS: STANDARD
NEUTRAL: 100.00%
VOLTAGE: 120/208 Wye
PHASE: 3
WIRE: 4
MIN A.I.C. RATING: 10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - HOT FOOD SERVING COUNTER	50 A	1	2000	3600					1	20 A	BREATH PROTECTION	2
3	REC - HOT HOLDING CABINET	15 A	1			1440	420			1	15 A	REC - COLD SERVING	4
5	REC - KITCHEN SPARES DOC	20 A	1					540	6365				6
7				6365	6365					3	70 A	(LOCKABLE BKR) STACKED CONVECTION OVEN 2	8
9	(LOCKABLE BKR) STACKED CONVECTION OVEN 1	70 A	3			6365	6365						10
11								6365	--	1	--	SHUNT TRIP - CONVECTION OVEN 2	12
13	SHUNT TRIP - CONVECTION OVEN 1	--	1	--	3579								14
15						3579	3579			3	40 A	(LOCKABLE BKR) CONVECTION STEAMER 2	16
17	(LOCKABLE BKR) CONVECTION STEAMER 1	40 A	3					3579	3579				18
19				3579	--					1	--	SHUNT TRIP - CONVECTION STEAMER 2	20
21	SHUNT TRIP - CONVECTION STEAMER 1	--	1			--	180			1	20 A	REC - GENERAL USE	22
23								3579	--	1	--	SHUNT TRIP - REC - GENERAL USE	24
25	(LOCKABLE BKR) INDUCTION RANGE	45 A	3	3579	500					1	20 A	VENT HOOD LIGHTING	26
27						3579	240			1	15 A	HOOD FIRE SUPPRESSION	28
29	SHUNT TRIP - INDUCTION RANGE	--	1					--	1080	1	15 A	REACH-IN FREEZER	30
31	REC - HOT FOOD SERVING COUNTER	50 A	1	2000	624					1	15 A	PASS-THRU REFRIGERATOR	32
33	REC - KITCHEN SPARES DOC	20 A	1			360	828			1	15 A	REACH-IN REFRIGERATOR	34
35	REC - KITCHEN SPARES DOC	20 A	1					540	1057				36
37	REC - MILK COOLER	15 A	1	912	1057					3	20 A	REC - GARBAGE DISOSAL	38
39	REC - KITCHEN SPARES DOC	20 A	1			1260	1057						40
41	REC - PRE-WIRED COUNTERS	20 A	1					120	1057				42
43	REC - PRE-WIRED COUNTERS	20 A	1	120	1057					3	20 A	REC - GARBAGE DISOSAL	44
45	REC - POINT OF SALES - SERVERY	20 A	1			1080	1057						46
47	REC - POINT OF SALES - SERVERY	20 A	1					1080	1176	1	20 A	FIRE DOOR - SERVERY 135	48
49	REC - EXTERIOR SERVICE YARD	20 A	1	540	1176					1	20 A	FIRE DOOR - SERVERY 135	50
51	SPARE	20 A	1			0	1176			1	20 A	COIL DOOR - SERVERY 135	52
53	SPARE	20 A	1					0	0	1	20 A	SPARE	54
55	SPARE	20 A	1	0	0					1	20 A	SPARE	56
57	SPACE	--	1			--	0			1	20 A	SPARE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
		TOTAL LOAD:		37053 VA		32564 VA		30116 VA					
		TOTAL AMP:		312 A		275 A		251 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
KITCHEN EQUIPMENT - NON-DWELLING UNIT	91805 VA	65.00%	59674 VA		
Motor	3528 VA	108.33%	3822 VA	**CONNECTED LOAD:**	100 kVA
RECEPTACLE	3660 VA	100.00%	3660 VA	**DEMAND LOAD:**	68 kVA
POWER	740 VA	100.00%	740 VA	**TOTAL CONNECTED:**	277 A
				TOTAL DEMAND:	188 A

NOTES:

PANEL NAME: HR5

PANEL LOCATION: STORAGE 181
ENCLOSURE: TYPE 1
MOUNTING: SURFACE
MAIN: 50 A
BUSSING: 100A
GROUND BUS: STANDARD
NEUTRAL: 100.00%
VOLTAGE: 120/208 Wye
PHASE: 3
WIRE: 4
MIN A.I.C. RATING: 10,000

CKT	DESCRIPTION	BKR SIZE	P	A		B		C		P	BKR SIZE	DESCRIPTION	CKT
1	REC - GENERAL USE	20 A	1	720	720					1	20 A	REC - GENERAL USE	2
3	LTG - STOR. 181, EXTERIOR	20 A	1			194	0			1	20 A	SPARE	4
5	SPARE	20 A	1					0	--	1	--	SPACE	6
7	SPACE	--	1	--	--					1	--	SPACE	8
9	SPACE	--	1			--	--			1	--	SPACE	10
11	SPACE	--	1					--	--	1	--	SPACE	12
13	SPACE	--	1	--	--					1	--	SPACE	14
15	SPACE	--	1			--	--			1	--	SPACE	16
17	SPACE	--	1					--	--	1	--	SPACE	18
19	SPACE	--	1	--	--					1	--	SPACE	20
		TOTAL LOAD:		1440 VA		194 VA		0 VA					
		TOTAL AMP:		12 A		2 A		0 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED LOAD	PANEL TOTALS	
RECEPTACLE	1440 VA	100.00%	1440 VA		
LIGHTING	194 VA	125.00%	243 VA	**CONNECTED LOAD:**	2 kVA
				DEMAND LOAD:	2 kVA
				TOTAL CONNECTED:	5 A
				TOTAL DEMAND:	5 A

NOTES:
PROVIDE WITH SERVICE ENTRANCE RATED MAIN BREAKER.

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Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201062104
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PANEL SCHEDULES - 208/120V PANELS

SHEET NO.
E6.2

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GENERATOR PERFORMANCE REQUIREMENTS

BASIS OF DESIGN: 450KW CUMMINS NATURAL GAS GENERATOR MODEL C450N6

RUNNING KW:	351
RUNNING KVA:	434
RUNNING PF:	0.81
MAX START KW:	159 IN STEP 2
MAX START KVA:	199 IN STEP 2
VOLTAGE DIP:	7.00%
FREQUENCY DIP:	4.00%
VOLTAGE HARMONIC DISTORTION:	10.00%
MAX LOAD:	85.00%
MIN LOAD:	25.00%

LOAD PROFILE

STEP 1:	EM LIGHTING 5 KW	SR1 W/O WALK-IN CONDENERS	RTU/DOAS	
STEP 2:	RTU-156	RTU-156 HEATER	COOLER CONDENSER	KEF-101, EF-100
STEP 3:	RTU-136	RTU-136 HEATER	FREEZER CONDENSER	KEF-102
STEP 4:				

ENCLOSURE TYPE:
PROVIDE WITH LEVEL 1 SOUND-ATTENUATED ENCLOSURE WITH A MAXIMUM AVERAGE SOUND OF 79dB(A) AT 23' FROM SURFACE OF GENSET AND 48" AFF.

NOTE: ALTERNATIVE LISTED ACCEPTABLE MANUFACTURER'S GENERATOR SETS MUST MEET OR EXCEED THE PERFORMANCE REQUIREMENTS AS SHOWN ABOVE. GENERATORS WITH RATED OUTPUTS HIGHER OR LOWER THAN THE BASIS OF DESIGN WILL BE ACCEPTABLE PROVIDED THEY MEET THE METRICS LISTED.

PHOTOVOLTAIC KEYNOTES

N1 FOR SOLAREDGE INVERTERS AUTOMATIC RAPID SHUTDOWN IS INTEGRATED INTO THE SOLAR EDGE SYSTEM WITH POWER OPTIMIZERS. RAPID SHUTDOWN IS INITIATED UPON AC GRID DISCONNECTION. THIS METHOD COMPLIES WITH NEC 2017 ARTICLE 690.12. IF ANOTHER INVERTER MANUFACTURER IS SELECTED AS AN EQUAL VERIFY COMPLIANCE WITH THE STATED CODE SECTION AND IF ADDITIONAL RAPID SHUTDOWN DEVICES ARE REQUIRED PER MANUFACTURER RECOMMENDATIONS. THE PV SYSTEM SHALL BE LABELED TO INDICATE RAPID SHUTDOWN AS FOLLOWS: "SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN" IN ACCORDANCE WITH NEC ARTICLE 690.

N2 AT EACH PV SYSTEM SOURCE DISCONNECTING MEANS PROVIDE A PERMANENT PLAQUE WITH A MAP OF THE ENTIRE PV SYSTEM WITH SYSTEM SIZE, LABELED ARRAYS, LABELED INVERTERS, AND DISCONNECT LOCATIONS. REFER TO NEC 705.10.

N3 LABEL FOR PV DISCONNECTING MEANS SHALL READ:

N4 COORDINATE WITH PHOTOVOLTAIC RACKING MANUFACTURER FOR GROUNDING CONNECTION TO ARRAY. GROUND SYSTEM IN ACCORDANCE WITH NEC ARTICLES 690 AND 250.

N5 PROVIDE PERMANENT LABEL PER INVERTER INDICATING ARRAY NUMBER AND INVERTER NUMBER AS FOLLOWS:
ARRAY #X
SYSTEM INVERTER #X

N6 LABEL FOR PV SYSTEM MAIN DISCONNECTING MEANS SHALL READ:

PV SYSTEM DISCONNECT

WARNING
POWER SOURCE OUTPUT CIRCUIT CONNECTION.
DO NOT RELOCATE THIS OVERCURRENT DEVICE.
ELECTRIC SHOCK HAZARD. TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

N7 PROVIDE THE FOLLOWING PERMANENT LABEL. ADDITIONAL LOCATIONS FOR PLACEMENT OF THIS LABEL MAY BE STIPULATED BY THE AHJ UPON SITE REVIEW. LABEL SHALL READ:

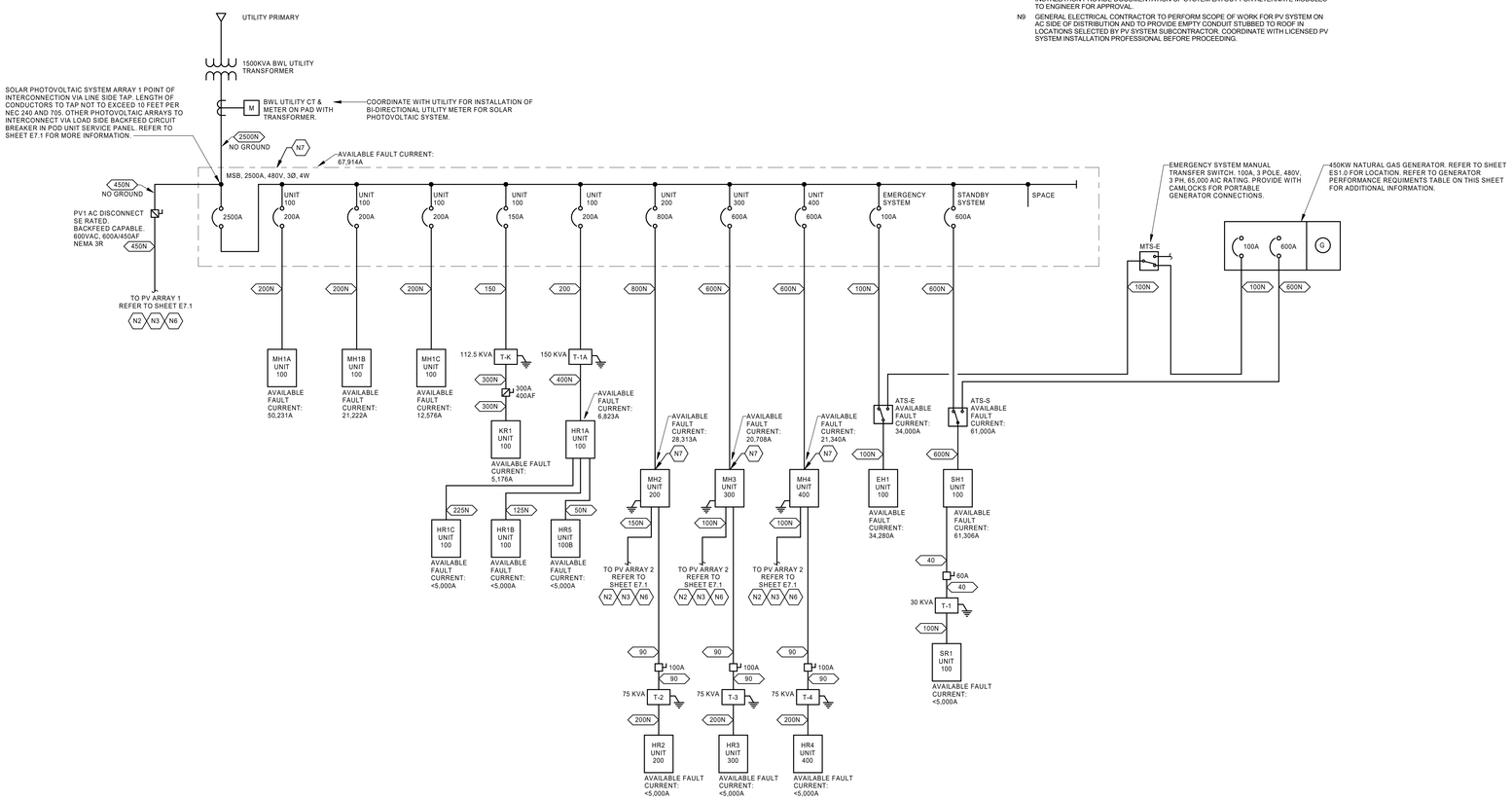
WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES.
TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR

N8 VERIFY PV CONDUCTOR SIZING REQUIREMENTS WITH INVERTER MANUFACTURER AND PV STRING SIZE. REFER TO INVERTER INSTALLATION MANUAL FOR RECOMMENDED PV CONDUCTOR SIZING AND COORDINATE WITH ENGINEER FOR VOLTAGE DROP OVER INDUSTRY STANDARD RUN LENGTHS FOR SYSTEM DC VOLTAGE SIZE. VERIFY ANTICIPATED PATH OF CONDUCTORS ON ROOF WITH ENGINEER BEFORE PROCEEDING WITH INSTALLATION PROVIDE DOCUMENTATION OF SYSTEM LAYOUT FOR ALTERNATE MODULES TO ENGINEER FOR APPROVAL.

N9 GENERAL ELECTRICAL CONTRACTOR TO PERFORM SCOPE OF WORK FOR PV SYSTEM ON AC SIDE OF DISTRIBUTION AND TO PROVIDE EMPTY CONDUIT STUBBED TO ROOF IN LOCATIONS SELECTED BY PV SYSTEM SUBCONTRACTOR. COORDINATE WITH LICENSED PV SYSTEM INSTALLATION PROFESSIONAL BEFORE PROCEEDING.

PHOTOVOLTAIC GENERAL NOTES

1. PROVIDE ALL LABELING FOR SYSTEM COMPONENTS AS REQUIRED BY NEC ARTICLE 690 AND 705. WARNING SIGNS OR LABELS SHALL COMPLY WITH NEC ARTICLE 110.
2. PV WIRING ENCLOSURES THAT CONTAIN DC CONDUCTORS SUCH AS EXPOSED RACEWAYS, COVERS, PULL BOXES, AND JUNCTION BOXES, SHALL BE MARKED WITH THE WORDING WARNING: PHOTOVOLTAIC POWER SOURCE BY MEANS OF PERMANENTLY AFFIXED LABELS OR OTHER APPROVED MARKING



ELECTRICAL ONE-LINE/RISER DIAGRAM

NO SCALE

PHOTOVOLTAIC LOAD TOTAL - MSB

MSB BUS RATING	2500
1.20 x PANELBOARD BUS RATING	3000
PANEL MAIN OCPD	2500
ARRAY 1- TOTAL INVERTER OUTPUT (A)	360 - NOT USED FOR SUMMATION DUE TO LINE SIDE CONNECTION
MH2 - ARRAY 2 - TOTAL INVERTER OUTPUT (A)	120
MH3 - ARRAY 3 - TOTAL INVERTER OUTPUT (A)	73
MH4 - ARRAY 4 - TOTAL INVERTER OUTPUT (A)	73
1.25% x INVERTER OUTPUT	332.5
SUM OF MAIN CIRCUIT BREAKER RATING AND 125% OF INVERTER OUTPUT. REQUIRED TO BE ≤ 120% OF PANELBOARD BUS RATING.	2832.5
REFER TO NEC 705.12(D)(2)(3)(C) FOR MORE INFORMATION.	

PHOTOVOLTAIC LOAD TOTAL - PANEL MH2

PANEL BUS RATING	800
1.20 x PANELBOARD BUS RATING	960
PANEL MAIN OCPD	800
MH2 - ARRAY 2 - TOTAL INVERTER OUTPUT (A)	120
1.25% x INVERTER OUTPUT	150
SUM OF MAIN CIRCUIT BREAKER RATING AND 125% OF INVERTER OUTPUT. REQUIRED TO BE ≤ 120% OF PANELBOARD BUS RATING.	950
REFER TO NEC 705.12(D)(2)(3)(C) FOR MORE INFORMATION.	

PHOTOVOLTAIC LOAD TOTAL - PANEL MH3

PANEL BUS RATING	600
1.20 x PANELBOARD BUS RATING	720
PANEL MAIN OCPD	600
MH3 - ARRAY 3 - TOTAL INVERTER OUTPUT (A)	73
1.25% x INVERTER OUTPUT	91.25
SUM OF MAIN CIRCUIT BREAKER RATING AND 125% OF INVERTER OUTPUT. REQUIRED TO BE ≤ 120% OF PANELBOARD BUS RATING.	691.25
REFER TO NEC 705.12(D)(2)(3)(C) FOR MORE INFORMATION.	

PHOTOVOLTAIC LOAD TOTAL - PANEL MH4

PANEL BUS RATING	600
1.20 x PANELBOARD BUS RATING	720
PANEL MAIN OCPD	600
MH4 - ARRAY 4 - TOTAL INVERTER OUTPUT (A)	73
1.25% x INVERTER OUTPUT	91.25
SUM OF MAIN CIRCUIT BREAKER RATING AND 125% OF INVERTER OUTPUT. REQUIRED TO BE ≤ 120% OF PANELBOARD BUS RATING.	691.25
REFER TO NEC 705.12(D)(2)(3)(C) FOR MORE INFORMATION.	

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SHEET NO.
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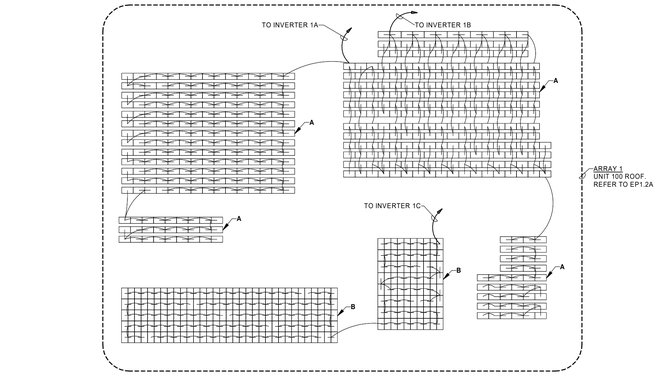
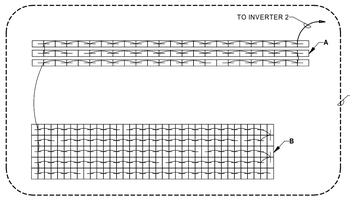
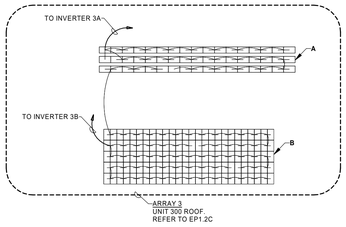
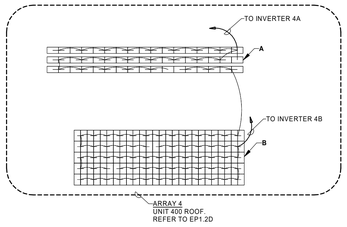








PHOTOVOLTAIC SYSTEM STRING WIRING DIAGRAM

NO SCALE

NOTES:

1. REFER TO LETTER DESIGNATIONS "A" AND "B" FOR EACH SUBARRAY.
2. SUBARRAYS THAT ARE TAGGED WITH "A" WILL BE PLACED ON A FLAT ROOF UTILIZING A BALLASTED RACKING SYSTEM. PV MODULES IN THE BALLASTED RACKING SYSTEM WILL HAVE A FIXED TILT OF 10 DEGREES. REFER TO MANUFACTURER INSTRUCTIONS FOR BALLAST CONFIGURATION AND BLOCKING PLACEMENT FOR THE SPECIFIED RACKING.
3. SUBARRAYS THAT ARE TAGGED WITH "B" WILL BE PLACED ON A TILTED ROOF UTILIZING A RAIL SYSTEM. PV MODULES IN THIS SYSTEM WILL BE FIXED TO THE TILT OF THE ROOF. FOR THE ANALYSIS OF THE PERFORMANCE OF THE SYSTEM 19 DEGREES WAS USED FOR THIS SUBARRAY TILT. REFER TO MANUFACTURER INSTRUCTIONS FOR MODULE PLACEMENT ON THE SPECIFIED RAIL MOUTNED RACKING SYSTEM.

MODULE SPECIFICATIONS

STC WATTS	410	W
STC VOC	49	V DC
STC VMP	42.7	V DC
STC IMP	9.61	A
STC ISC	10.35	A
PANEL EFFICIENCY	22.2	%
COLDEST DAY (-22°F, -30°C) VOC	38.3	V DC
WARMEST DAY (109°F, 42.8°C) VOC	37.1	V DC
DIMENSIONS	71.7 x 40 x 1.2	IN
WEIGHT	20.5	KG
FRAME: BLACK ANODIZED ALUMINUM		
CELL TYPE: MONO-SI		
ANNUAL DEGREDATION	0.25	%
WARRENTY	20	YEARS
MODULE BASIS OF DESIGN: REC SOLAR 410 AA PURE ALPHA		

30KW INVERTER SPECIFICATIONS

INPUT POWER	40,500	W
MAXIMUM INPUT CURRENT	39	A DC
MAXIMUM INPUT VOLTAGE	1,000	V DC
MAXIMUM OUTPUT POWER	30,000	W
MAXIMUM OUTPUT CURRENT	36.5	A AC
AC OUTPUT VOLTAGE (L-L)	480	V AC
WARRENTY	12	YEARS
INVERTER BASIS OF DESIGN: SE30KUS		

100KW INVERTER SPECIFICATIONS

INPUT POWER	175,000	W
MAXIMUM INPUT CURRENT	40	A DC
MAXIMUM INPUT VOLTAGE	1,000	V DC
MAXIMUM OUTPUT POWER	100,000	W
MAXIMUM OUTPUT CURRENT	120	A AC
AC OUTPUT VOLTAGE (L-L)	480	V AC
WARRENTY	12	YEARS

INVERTER BASIS OF DESIGN: SE100KUS

INVERTER REMOTE MONITORING TO BE INSTALLED BY ELECTRICAL CONTRACTOR, REAL TIME MONITORING SYSTEM TO BE SHOWN ON FLAT PANEL DISPLAY, REFER TO POWER PLANS FOR LOCATION.

REFER TO INVERTER MANUFACTURER INSTRUCTIONS FOR INSTALLATION CLEARANCES AND MOUNTING SYSTEMS REQUIRED.

MONTHLY AC ENERGY SUMMARY

MONTH	GLOBAL HORIZONTAL INSOLATION (GHI)	TOTAL ENERGY PRODUCED
	Wh/M2	kWh
JAN	67	30,596
FEB	104	47,585
MAR	151	65,706
APR	198	74,683
MAY	230	92,717
JUN	261	95,899
JUL	274	93,242
AUG	239	82,209
SEP	181	72,713
OCT	111	47,203
NOV	79	33,959
DEC	55	27,896
YEAR 1 TOTAL:		764,408

SYSTEM OVERVIEW:

1. INSTALLED DC POWER: 570 KW
2. MAX ACHIEVED AC POWER: 519 KW
3. TOTAL NUMBER OF PV MODULES: 1388
4. TOTAL NUMBER OF INVERTERS: 8
5. TOTAL NUMBER OF POWER OPTIMIZERS: 701
6. BASE BID SOLAREDGE PV MONITORING SYSTEM: INSTALL AND COORDINATE LOCATION OF MONITORS ON LCD DISPLAY SCREEN. REFER TO POWER PLANS FOR (4) SCREEN LOCATIONS. SYSTEM MONITORING DISPLAY TO COINCIDE WITH DISPLAY USED FOR GEOTHERMAL SYSTEM. WIFI CONNECTION TO INVERTERS IS TO BE USED FOR THE MONITORING SYSTEM.

PHOTOVOLTAIC KEYNOTES

N1 FOR SOLAREDGE INVERTERS AUTOMATIC RAPID SHUTDOWN IS INTEGRATED INTO THE SOLAR EDGE SYSTEM WITH POWER OPTIMIZERS. RAPID SHUTDOWN IS INITIATED UPON AC GRID DISCONNECTION. THIS METHOD COMPLIES WITH NEC 2017 ARTICLE 690.12. IF ANOTHER INVERTER MANUFACTURER IS SELECTED AS AN EQUAL VERIFY COMPLIANCE WITH THE STATED CODE SECTION AND IF ADDITIONAL RAPID SHUTDOWN DEVICES ARE REQUIRED PER MANUFACTURER RECOMMENDATIONS. THE PV SYSTEM SHALL BE LABELED TO INDICATE RAPID SHUTDOWN AS FOLLOWS: "SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN" IN ACCORDANCE WITH NEC ARTICLE 690.

N2 AT EACH PV SYSTEM SOURCE DISCONNECTING MEANS PROVIDE A PERMANENT PLAQUE WITH A MAP OF THE ENTIRE PV SYSTEM WITH SYSTEM SIZE, LABELED ARRAYS, LABELED INVERTERS, AND DISCONNECT LOCATIONS. REFER TO NEC 705.10.

N3 LABEL FOR PV DISCONNECTING MEANS SHALL READ:

N4 COORDINATE WITH PHOTOVOLTAIC RACKING MANUFACTURER FOR GROUNDING CONNECTION TO ARRAY. GROUND SYSTEM IN ACCORDANCE WITH NEC ARTICLES 690 AND 250.

N5 PROVIDE PERMANENT LABEL PER INVERTER INDICATING ARRAY NUMBER AND INVERTER NUMBER AS FOLLOWS:
ARRAY #X
SYSTEM INVERTER #X

N6 LABEL FOR PV SYSTEM MAIN DISCONNECTING MEANS SHALL READ:

PV SYSTEM DISCONNECT

WARNING
POWER SOURCE OUTPUT CIRCUIT CONNECTION.
DO NOT RELOCATE THIS OVERCURRENT DEVICE.
ELECTRIC SHOCK HAZARD. TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

N7 PROVIDE THE FOLLOWING PERMANENT LABEL. ADDITIONAL LOCATIONS FOR PLACEMENT OF THIS LABEL MAY BE STIPULATED BY THE AHJ UPON SITE REVIEW. LABEL SHALL READ:

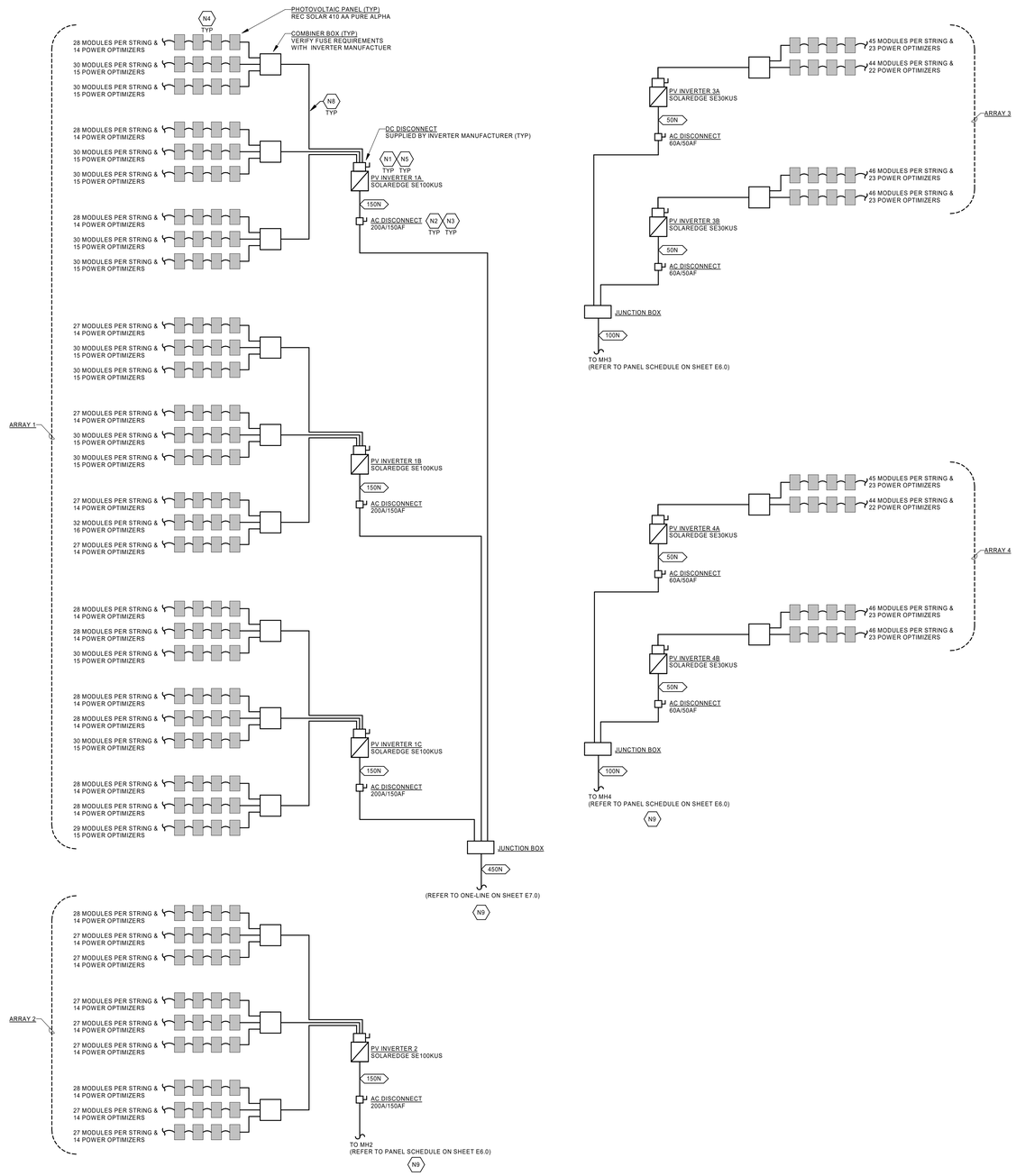
WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES.
TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR

N8 VERIFY PV CONDUCTOR SIZING REQUIREMENTS WITH INVERTER MANUFACTURER AND PV STRING SIZE. REFER TO INVERTER INSTALLATION MANUAL FOR RECOMMENDED PV CONDUCTOR SIZING AND COORDINATE WITH ENGINEER FOR VOLTAGE DROP OVER INDUSTRY STANDARD RUN LENGTHS FOR SYSTEM DC VOLTAGE SIZE. VERIFY ANTICIPATED PATH OF CONDUCTORS ON ROOF WITH ENGINEER BEFORE PROCEEDING WITH INSTALLATION PROVIDE DOCUMENTATION OF SYSTEM LAYOUT FOR ALTERNATE MODULES TO ENGINEER FOR APPROVAL.

N9 GENERAL ELECTRICAL CONTRACTOR TO PERFORM SCOPE OF WORK FOR PV SYSTEM ON AC SIDE OF DISTRIBUTION AND TO PROVIDE EMPTY CONDUIT STUBBED TO ROOF IN LOCATIONS SELECTED BY PV SYSTEM SUBCONTRACTOR. COORDINATE WITH LICENSED PV SYSTEM INSTALLATION PROFESSIONAL BEFORE PROCEEDING.

PHOTOVOLTAIC GENERAL NOTES

1. PROVIDE ALL LABELING FOR SYSTEM COMPONENTS AS REQUIRED BY NEC ARTICLE 690 AND 705. WARNING SIGNS OR LABELS SHALL COMPLY WITH NEC ARTICLE 110.
2. PV WIRING ENCLOSURES THAT CONTAIN DC CONDUCTORS SUCH AS EXPOSED RACEWAYS, COVERS, PULL BOXES, AND JUNCTION BOXES, SHALL BE MARKED WITH THE WORDING WARNING: PHOTOVOLTAIC POWER SOURCE BY MEANS OF PERMANENTLY AFFIXED LABELS OR OTHER APPROVED MARKING



PHOTOVOLTAIC ONE-LINE/RISER DIAGRAM

NO SCALE

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050104
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
PHOTOVOLTAIC RISER DIAGRAM

SHEET NO.
E7.1

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LIGHTING KEYNOTES

L1 LUMINAIRE L11 HAS A 4'-0" LENGTH IN CEILING SOFFIT AND TURNS 90 DEGREES DOWN THE WALL 4'-0". REFER TO ARCHITECTURAL DRAWINGS AND DETAILS FOR FURTHER INFORMATION.

L2 PROVIDE UL924 LISTED GENERATOR/EMERGENCY TRANSFER DEVICE FOR LUMINAIRE CIRCUIT AS INDICATED.

L3 OVERRIDE SWITCH FOR ALL EXTERIOR LUMINAIRES MOUNTED ON THIS BUILDING.

L4 OVERRIDE SWITCH FOR CORRIDOR LIGHTING.

L5 MOUNT LUMINAIRE S6 JUST UNDER TOP OF ROOF LINE IN PRE-FINISHED METAL DRIP EDGE. REFER TO ARCHITECTURAL ELEVATIONS.

L6 CENTER LUMINAIRE ON METAL SIDING AT TOP OF BUILDING ELEVATION. REFER TO ARCHITECTURAL EXTERIOR ELEVATIONS SHEETS A3.1A - A3.4.

LIGHTING GENERAL NOTES

1. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF ALL LIGHTING FIXTURES UNLESS OTHERWISE NOTED.
2. EXIT LIGHTS AND EMERGENCY BATTERY UNITS SHALL BE UNCONTROLLED AND TIED AHEAD OF LOCAL AREA LIGHTING SWITCH, UNLESS CIRCUITED OTHERWISE.
3. WHERE MORE THAN ONE LIGHT SWITCH IS INDICATED TO BE INSTALLED AT THE SAME LOCATION, THEY SHALL BE GROUPED UNDER ONE COMMON FACEPLATE.
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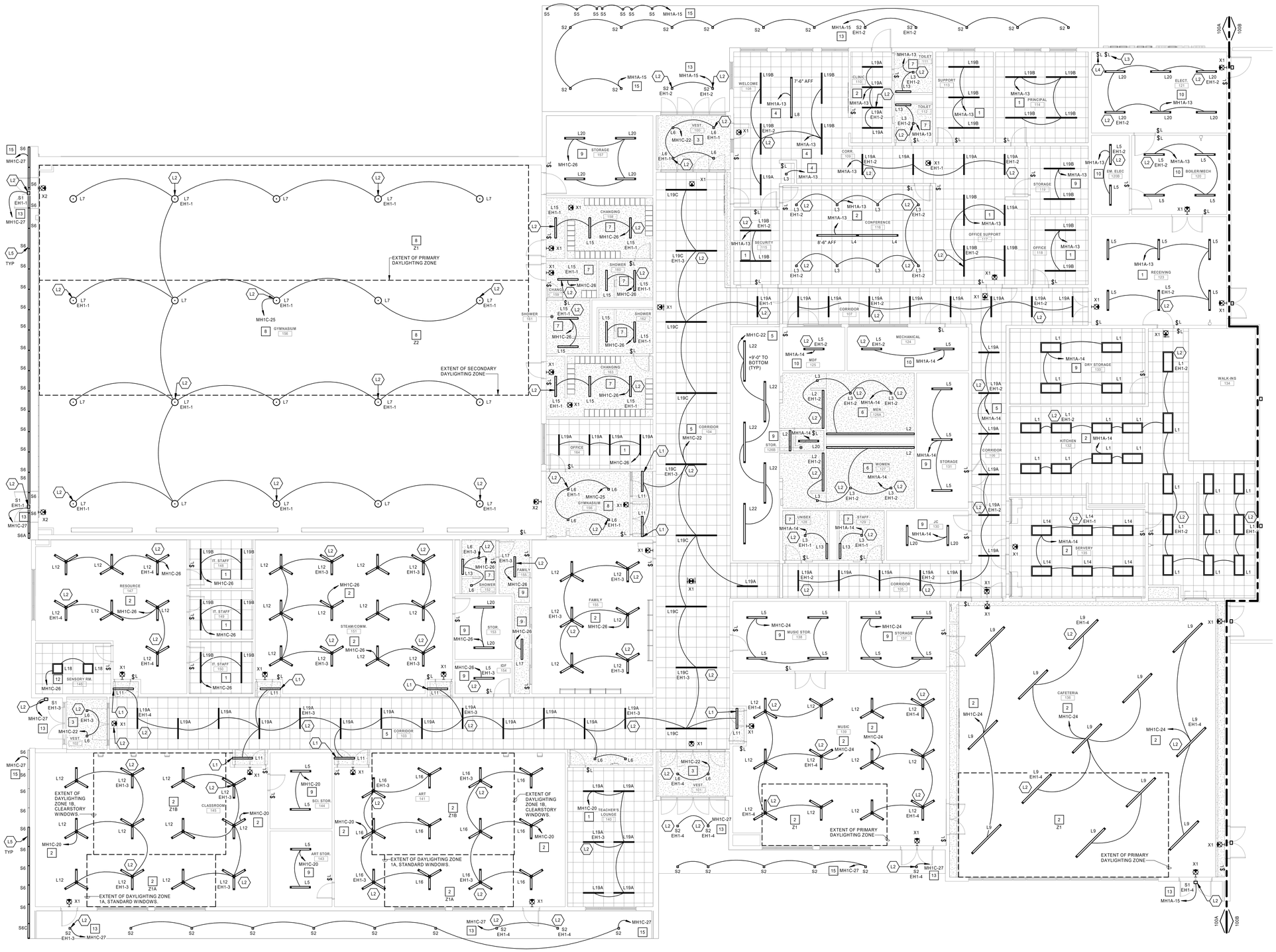
6. ALL CONDUITS SHALL BE ROUTED CONCEALED UNLESS NOTED OTHERWISE.



LIGHTING PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

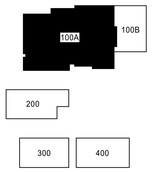
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 62010500200
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

ISD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
LIGHTING PLAN - UNIT 100A

SHEET NO.
EL1.1A

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LIGHTING GENERAL NOTES

1. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF ALL LIGHTING FIXTURES UNLESS OTHERWISE NOTED.
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LIGHTING KEYNOTES

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L4 OVERRIDE SWITCH FOR CORRIDOR LIGHTING.

L5 MOUNT LUMINAIRE S6 JUST UNDER TOP OF ROOF LINE IN PRE-FINISHED METAL DRIP EDGE. REFER TO ARCHITECTURAL ELEVATIONS.

L6 CENTER LUMINAIRE ON METAL SIDING AT TOP OF BUILDING ELEVATION. REFER TO ARCHITECTURAL EXTERIOR ELEVATIONS SHEETS A3.1A - A3.4.

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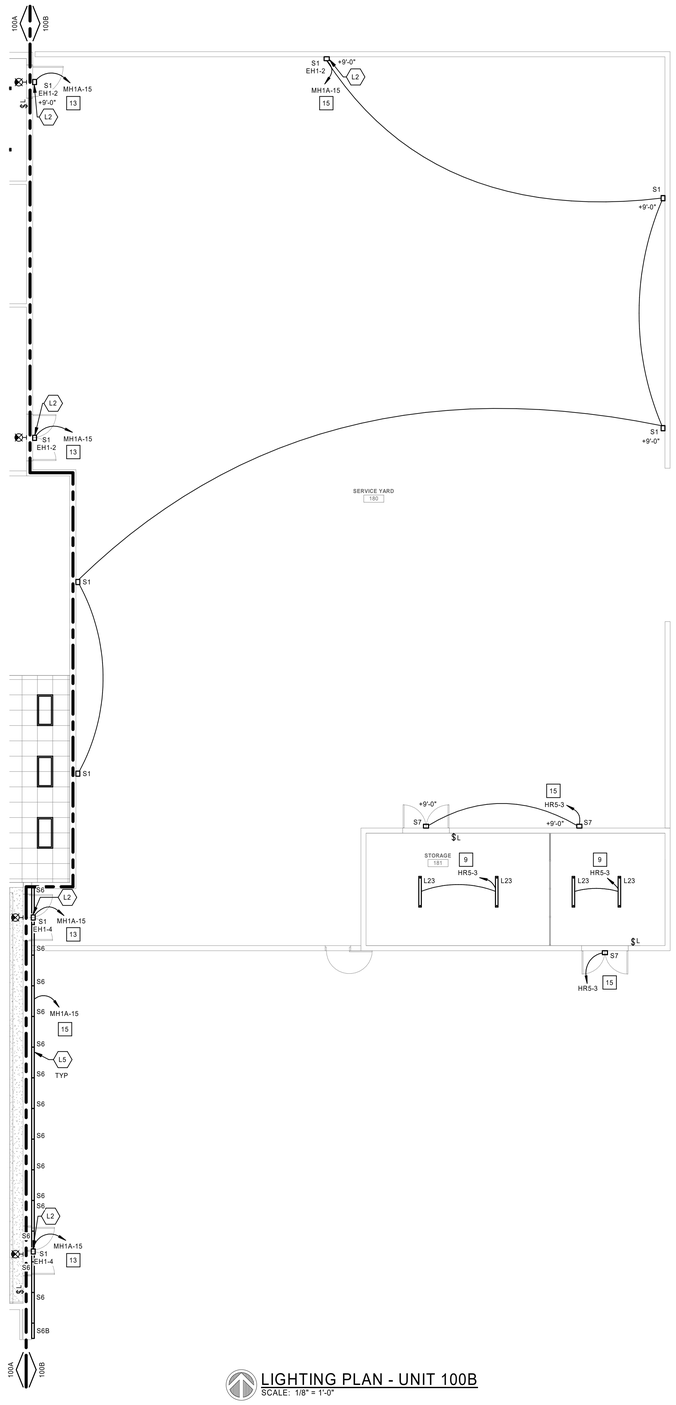
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



LIGHTING PLAN - UNIT 100B
SCALE: 1/8" = 1'-0"

Willow School

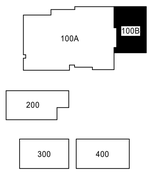
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSIEND
ENGINEER
No. 6201000400
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
LIGHTING PLAN - UNIT 100B

SHEET NO.
EL1.1B

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LIGHTING GENERAL NOTES

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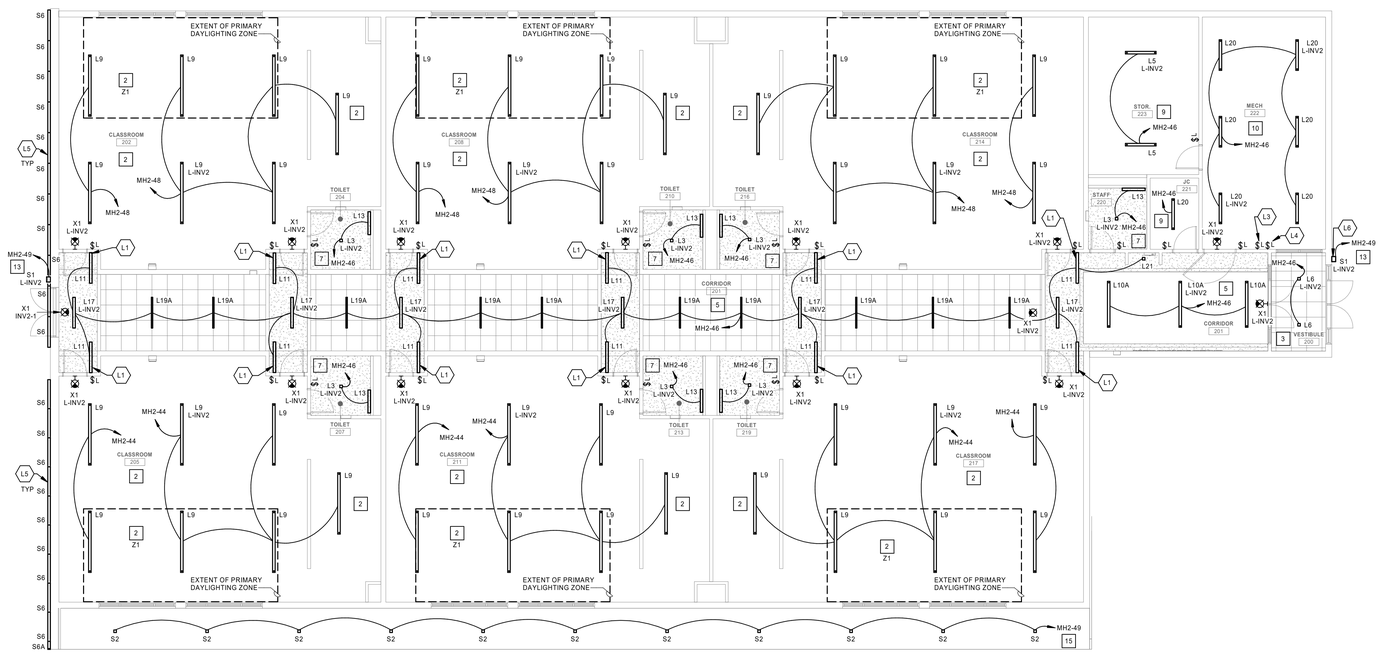
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

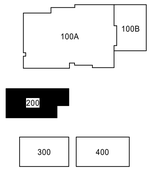


LIGHTING PLAN - UNIT 200
SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065193
LICENSED PROFESSIONAL ENGINEER
SEAL OF PROFESSION
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
LIGHTING PLAN - UNIT 200

SHEET NO.
EL1.2

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LIGHTING GENERAL NOTES

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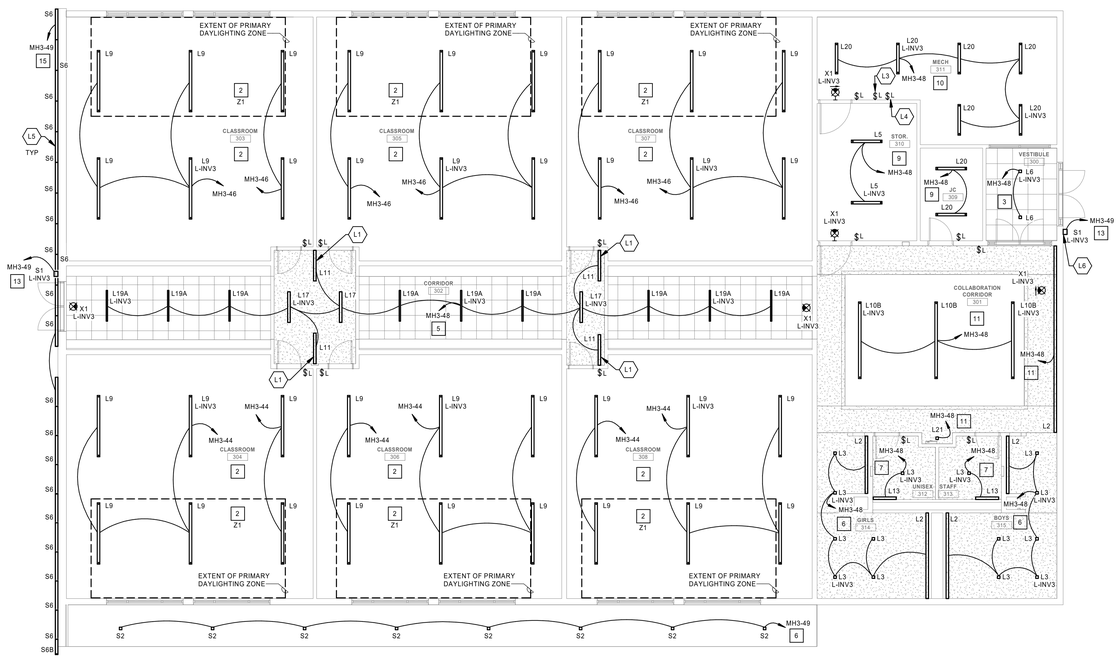
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



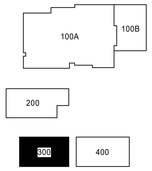
LIGHTING PLAN - UNIT 300

SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065193
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE

LIGHTING PLAN - UNIT 300

SHEET NO.

EL1.3

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C:\Users\jbrDocuments\23 5598 SS_LBO Willow_MEP_2023_jbrecker.rvt

LIGHTING GENERAL NOTES

1. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF ALL LIGHTING FIXTURES UNLESS OTHERWISE NOTED.
2. EXIT LIGHTS AND EMERGENCY BATTERY UNITS SHALL BE UNCONTROLLED AND TIED AHEAD OF LOCAL AREA LIGHTING SWITCH, UNLESS CIRCUITED OTHERWISE.
3. WHERE MORE THAN ONE LIGHT SWITCH IS INDICATED TO BE INSTALLED AT THE SAME LOCATION, THEY SHALL BE GROUPED UNDER ONE COMMON FACEPLATE.
4. ALL POWER PACKS TO BE LOCATED DIRECTLY ABOVE SWITCH.
5. LIGHT FIXTURES ARE LOOPED TOGETHER TO INDICATE CONTROL ZONE GROUPS. CONNECTED FIXTURES ARE TO BE CONTROLLED TOGETHER. CIRCUITS MAY BE SHARED AMONG SEPARATE CONTROL ZONE GROUPS. MULTIPLE ZONES ZONES MAY BE COMBINED IN SOFTWARE TO FORM SCENES. SEE LIGHTING CONTROL MATRIX, SCENE SCHEDULE (IF PROVIDED), AND PANEL SCHEDULES FOR ADDITIONAL INFORMATION.
6. ALL CONDUITS SHALL BE ROUTED CONCEALED UNLESS NOTED OTHERWISE.

LIGHTING KEYNOTES

L.1 LUMINAIRE L11 HAS A 4'-0" LENGTH IN CEILING SOFFIT AND TURNS 90 DEGREES DOWN THE WALL 4'-0". REFER TO ARCHITECTURAL DRAWINGS AND DETAILS FOR FURTHER INFORMATION.

L.2 PROVIDE UL924 LISTED GENERATOR/EMERGENCY TRANSFER DEVICE FOR LUMINAIRE CIRCUIT AS INDICATED.

L.3 OVERRIDE SWITCH FOR ALL EXTERIOR LUMINAIRES MOUNTED ON THIS BUILDING.

L.4 OVERRIDE SWITCH FOR CORRIDOR LIGHTING.

L.5 MOUNT LUMINAIRE S6 JUST UNDER TOP OF ROOF LINE IN PRE-FINISHED METAL DRIP EDGE. REFER TO ARCHITECTURAL ELEVATIONS.

L.6 CENTER LUMINAIRE ON METAL SIDING AT TOP OF BUILDING ELEVATION. REFER TO ARCHITECTURAL EXTERIOR ELEVATIONS SHEETS A3.1A - A3.4.

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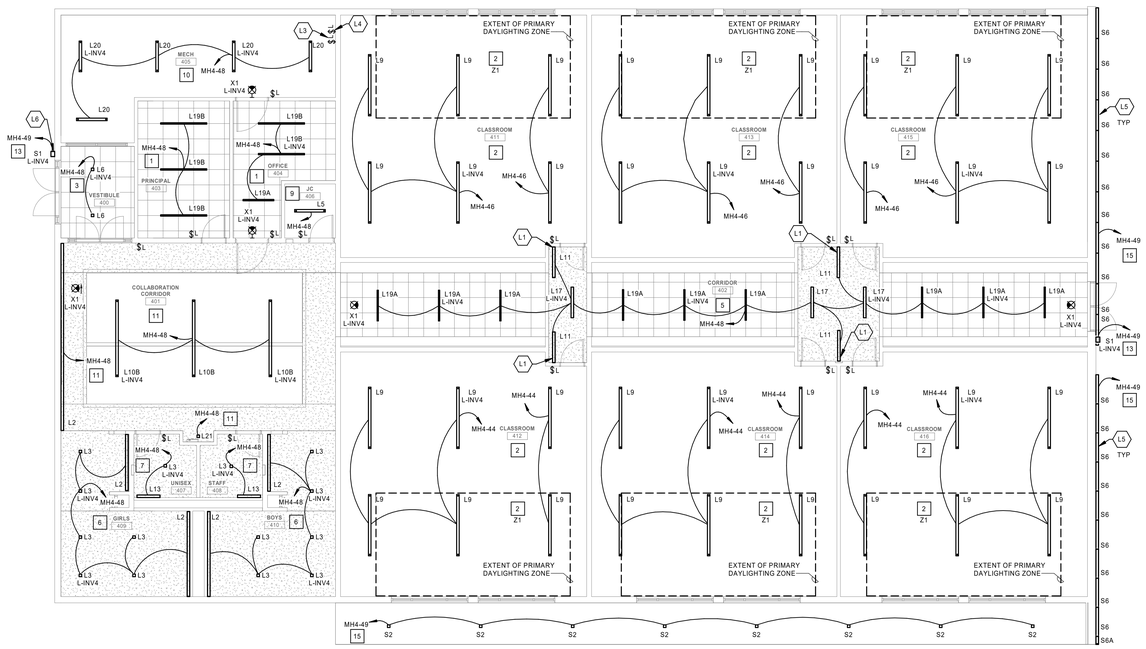
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915



LIGHTING PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065193
LICENSED PROFESSIONAL ENGINEER
SUPERVISOR
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A 100B 200 300 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
LIGHTING PLAN - UNIT 400

SHEET NO.
EL1.4

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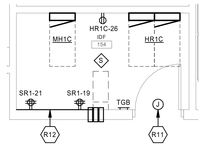

2 EP1.1A ENLARGED IDF POWER PLAN
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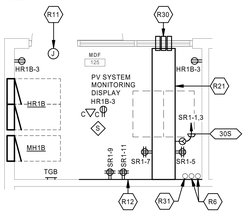

3 EP1.1A ENLARGED MDF POWER PLAN
SCALE: 1/4" = 1'-0"

POWER KEYNOTES

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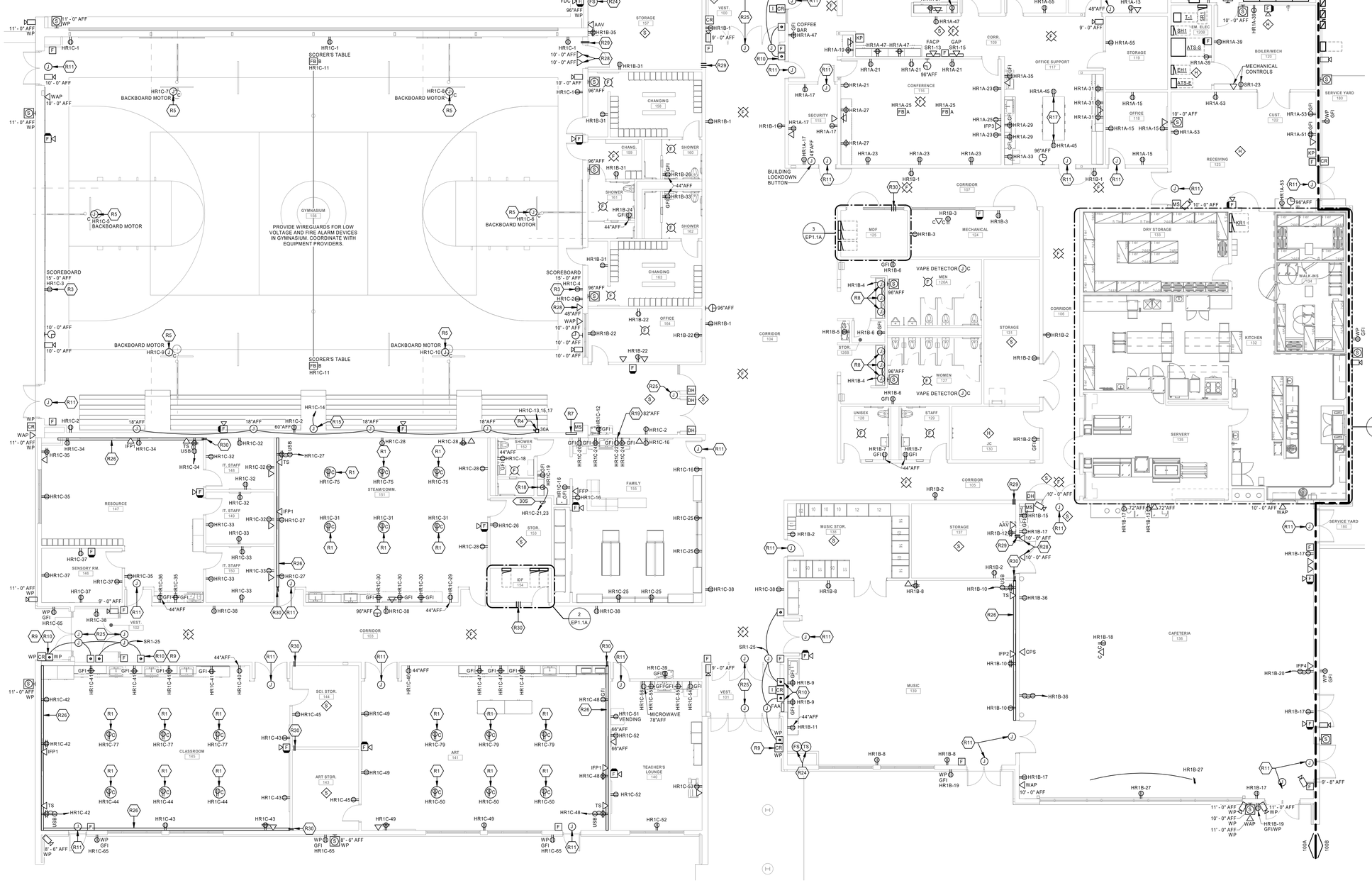


POWER PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

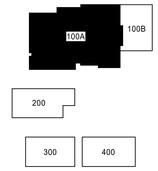
Willow School

Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201005024
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
POWER PLAN - UNIT 100A

SHEET NO.
EP1.1A

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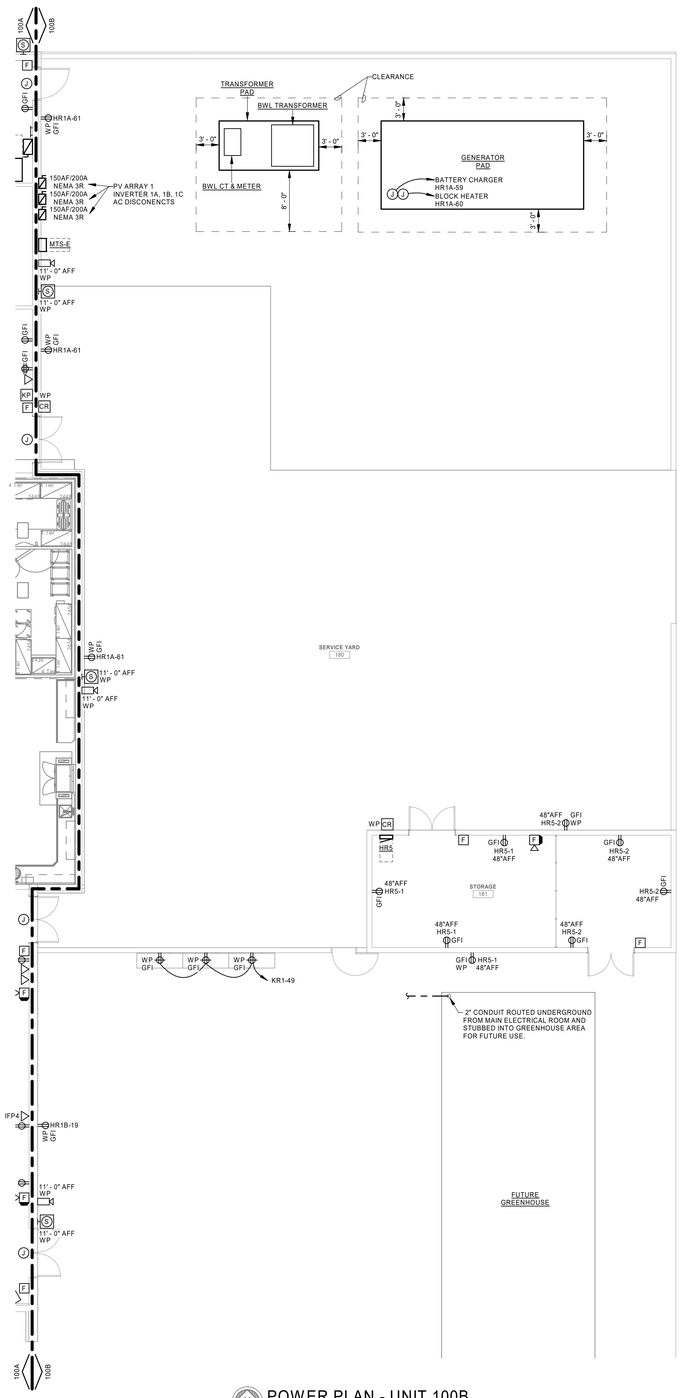
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



POWER PLAN - UNIT 100B
SCALE: 1/8" = 1'-0"

Willow School

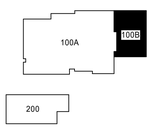
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201005400
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
POWER PLAN - UNIT 100B

SHEET NO.
EP1.1B

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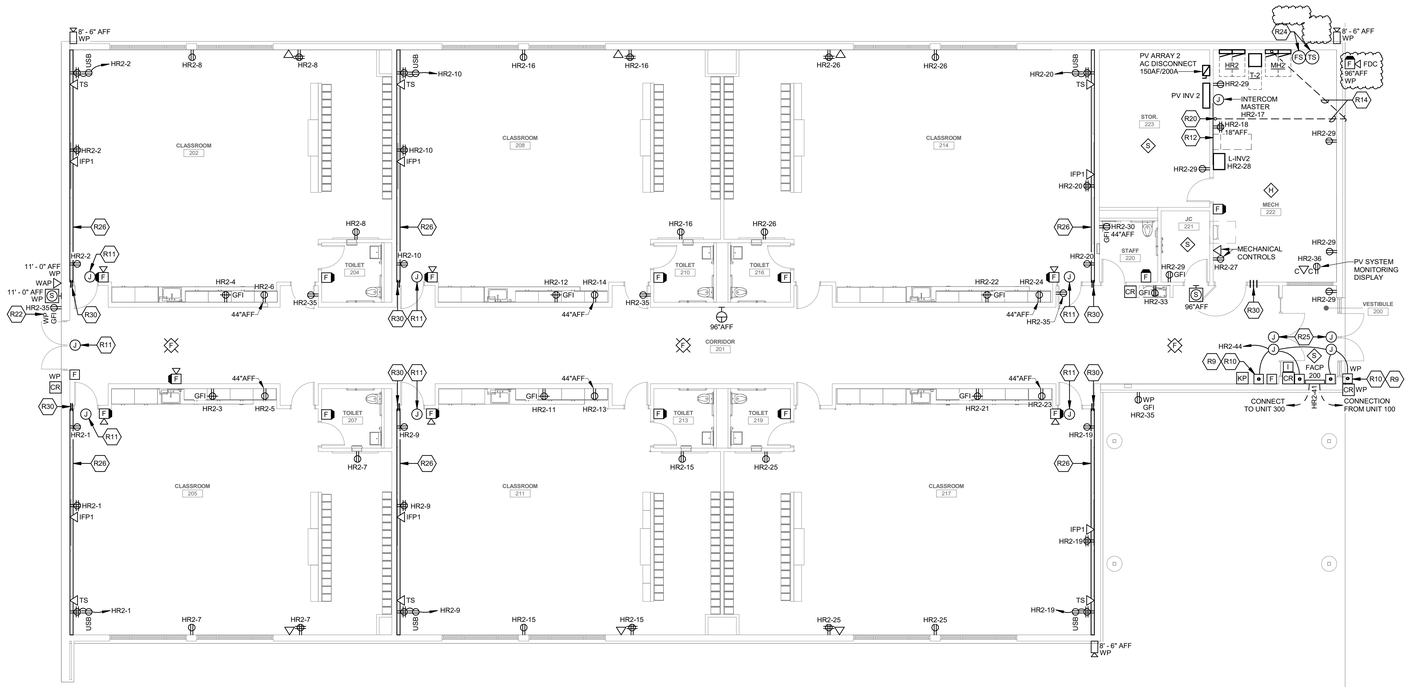

POWER PLAN - UNIT 200
SCALE: 1/8" = 1'-0"

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANC	DAT
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

200

300 400

KEY PLAN

LSD SB-005
JOB 2616.01A

N

SHEET
POWER PLAN - UNIT 200

SHEET
EP1.2

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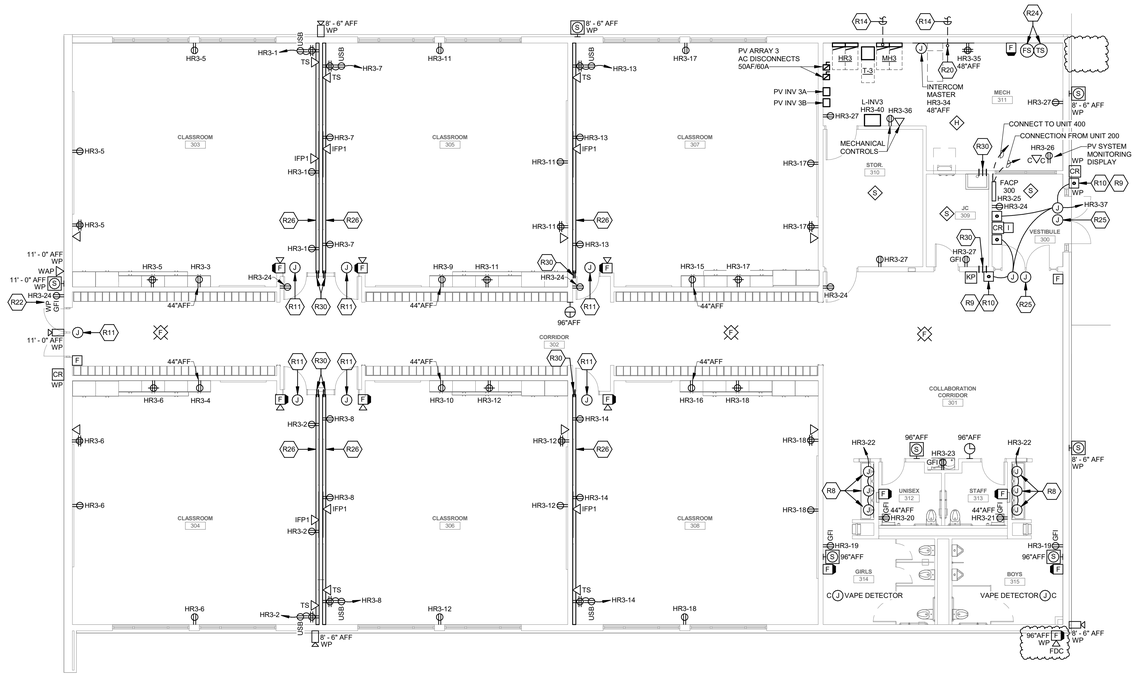

POWER PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANC	DAT
Bid and Construction	01.26.2024
Addendum 03	03.15.2024

100A 100B 200 300 400

KEY PLAN
LSD SB-005
JOB 2616.01A
N

SHEET
POWER PLAN - UNIT 300

SHEET
EP1.3

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R33 PV ARRAY ON FLAT ROOF TO UTILIZE BALLASTED RACKING SYSTEM UNIRAC RM10. COORDINATE COMPONENTS AND INSTALL WITH RACKING MANUFACTURER.

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2. REFER TO ARCHITECTURAL FLOOR PLANS AND ELEVATIONS TO VERIFY LOCATION OF DEVICES.
3. ALL CONDUITS SERVING 120 VOLTS OR GREATER SHALL INCLUDE A GROUND WIRE.
4. ALL CONDUITS SHALL BE ROUTED CONCEALED UNLESS NOTED OTHERWISE.
5. ALL 120 VOLT CIRCUITS SHALL UTILIZE A SEPARATE NEUTRAL.

ELECTRICAL CONTRACTOR TO COORDINATE FINAL SIZES, QUANTITIES, HEIGHTS, AND LOCATIONS FOR LOW VOLTAGE BACKBOX AND CONDUIT WITH LOW VOLTAGE DOCUMENTS ON T-SERIES SHEETS PRIOR TO INSTALLATION.

ELECTRICAL CONTRACTOR TO PROVIDE WALL SLEEVES AS SHOWN ON POWER DOCUMENTS AS WELL AS ANY ADDITIONAL SLEEVES NEEDED DURING CONSTRUCTION FOR LOW VOLTAGE INSTALLER CABLE PATHWAYS.

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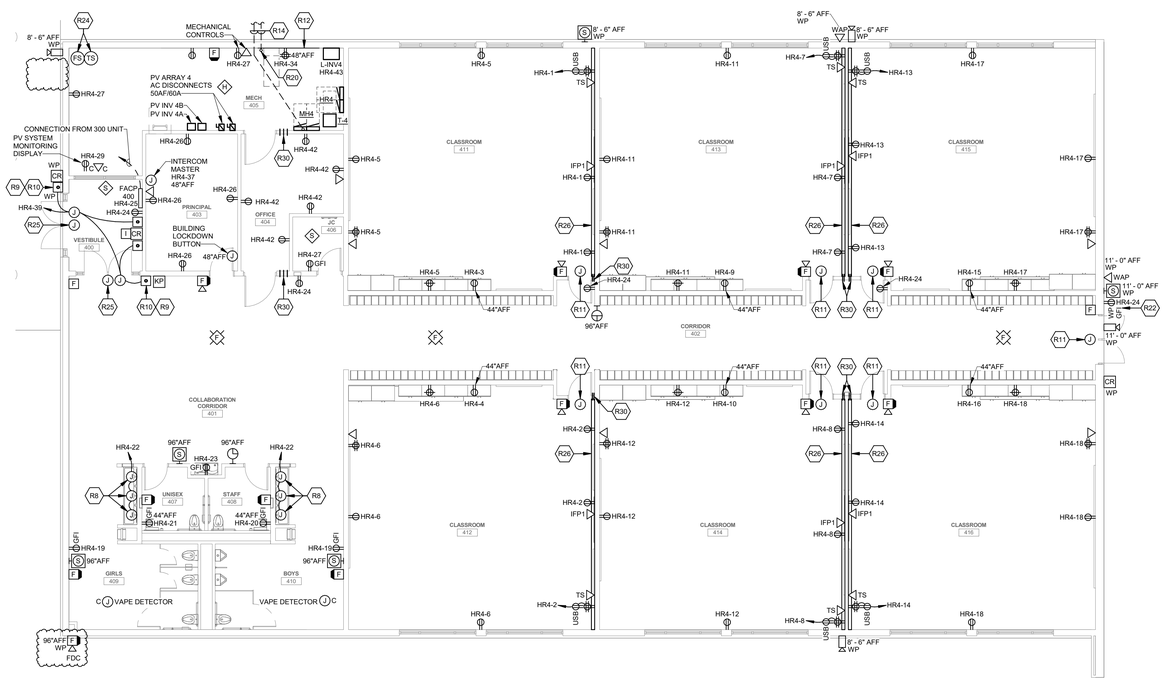
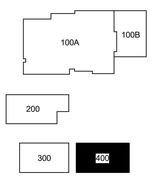


POWER PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

Lansing School District

ISSUANC	DAT
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN
LSD SB-005
JOB 2616.01A
N

SHEET
POWER PLAN - UNIT 400

SHEET
EP1.4

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

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POWER KEYNOTES

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KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

POWER MECHANICAL EQUIPMENT PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050104
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

100A | 100B | 200 | 300 | 400

KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
POWER MECHANICAL EQUIPMENT PLAN - UNIT 100A

SHEET NO.
EP2.1A

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LAST EDIT: Friday, January 26, 2024 5:43 PM
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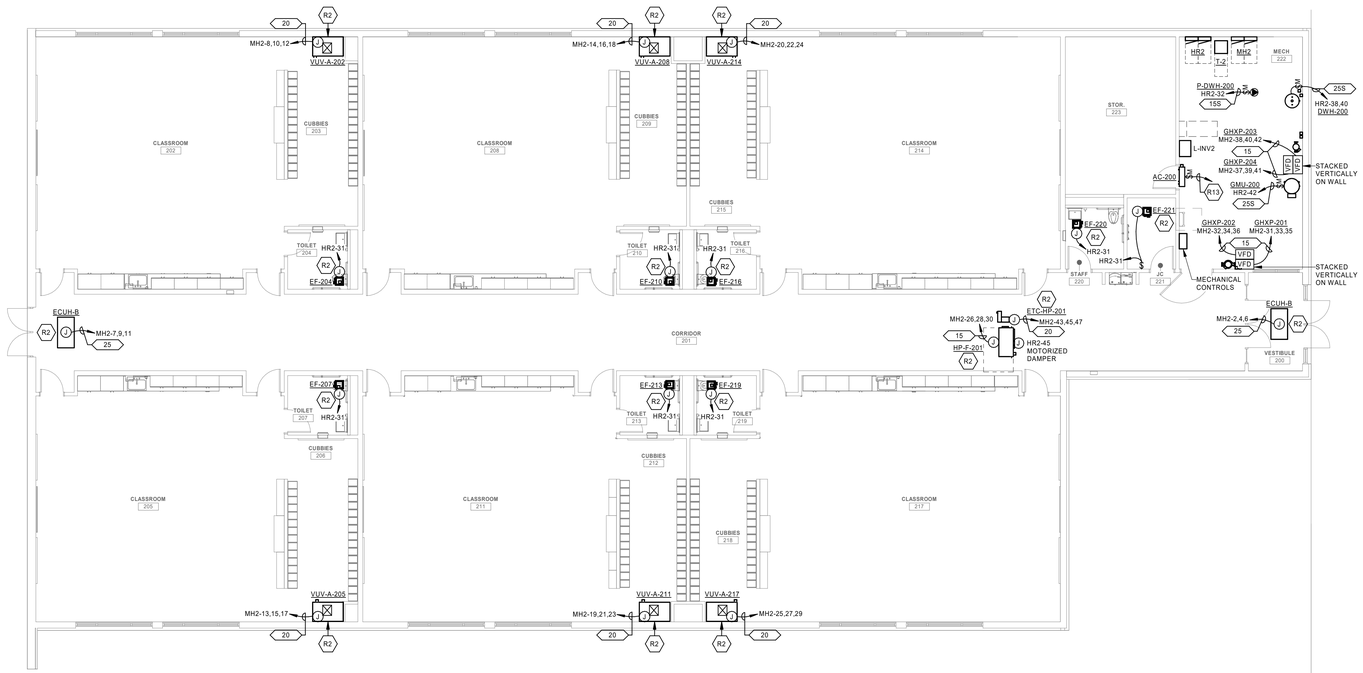
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

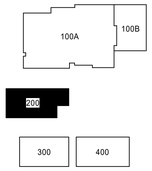


POWER MECHANICAL EQUIPMENT PLAN - UNIT 200
SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065193
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
POWER MECHANICAL EQUIPMENT PLAN - UNIT 200

SHEET NO.
EP2.2

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POWER KEYNOTES

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POWER KEYNOTES

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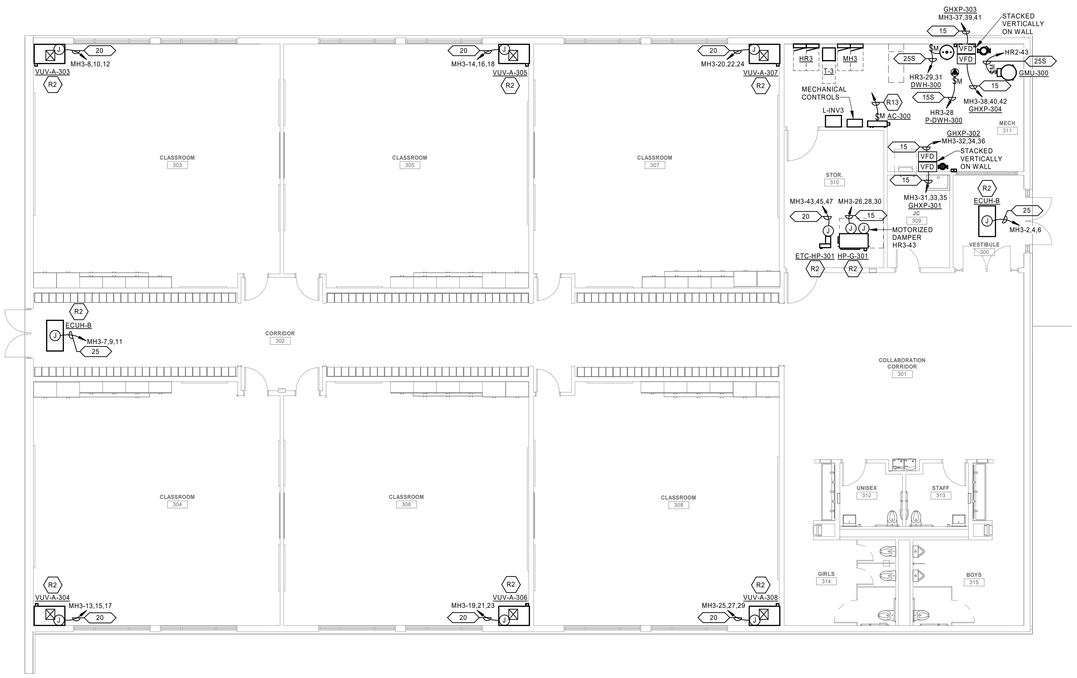
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

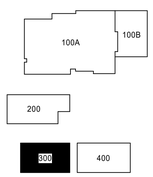


POWER MECHANICAL EQUIPMENT PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065103
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
POWER MECHANICAL EQUIPMENT PLAN - UNIT 300

SHEET NO.
EP2.3

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Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

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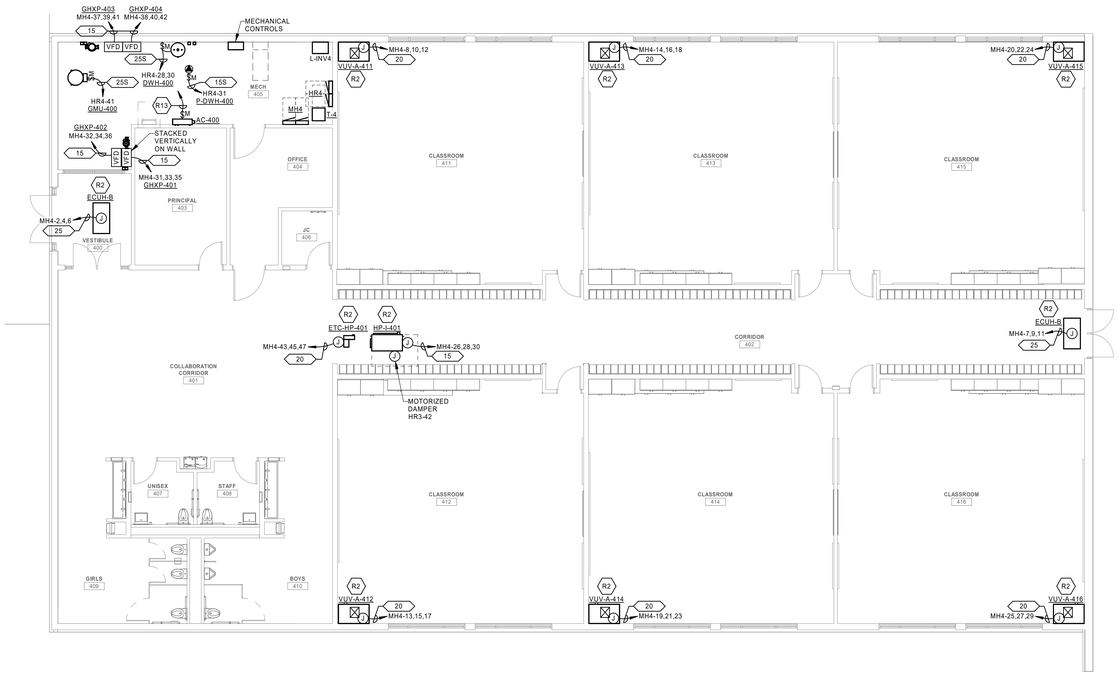
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



POWER MECHANICAL EQUIPMENT PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

Willow School

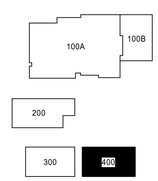
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065103
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
POWER MECHANICAL EQUIPMENT PLAN - UNIT 400

SHEET NO.
EP2.4

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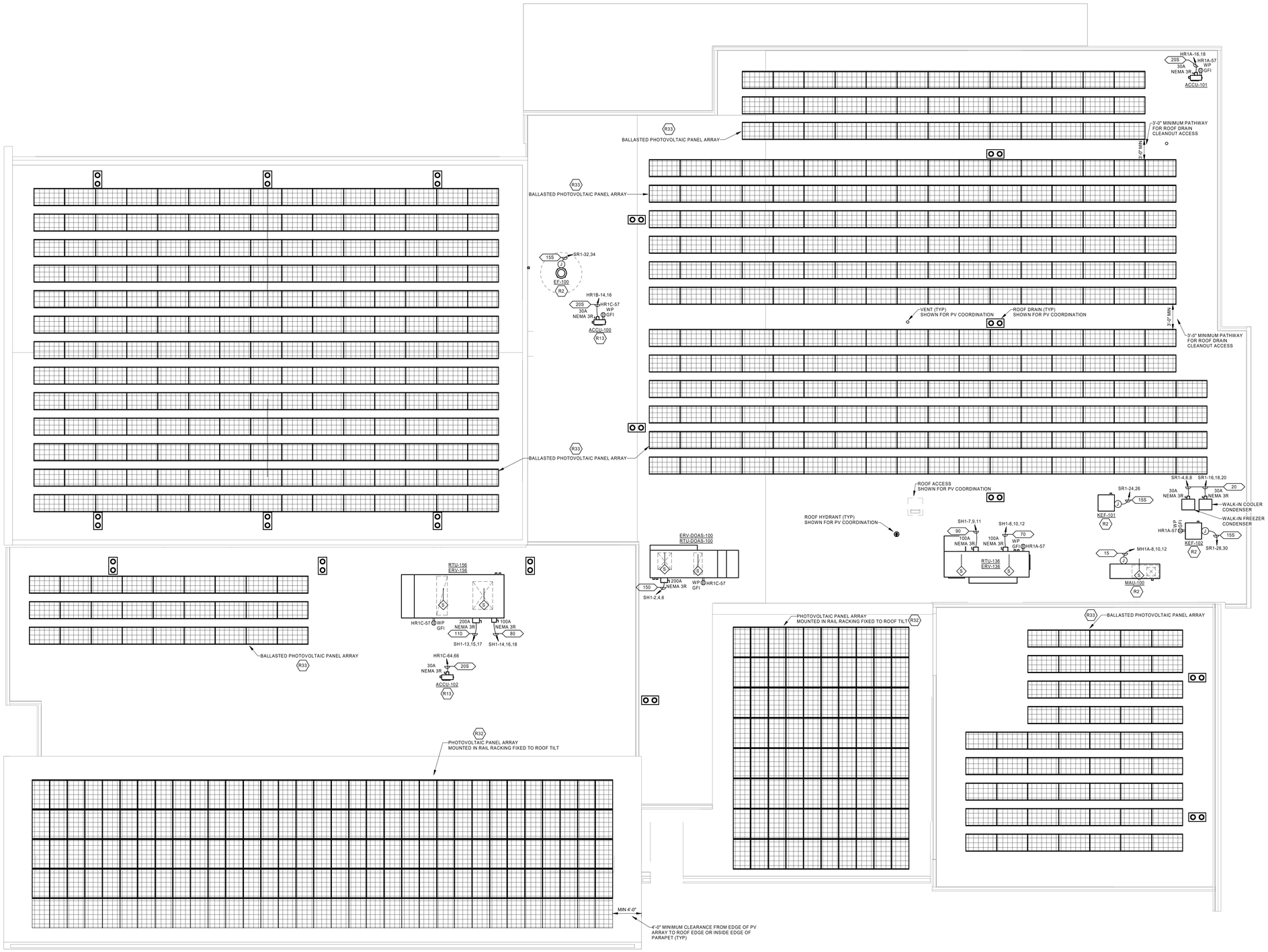


ROOF POWER PLAN - UNIT 100A
SCALE: 1/8" = 1'-0"

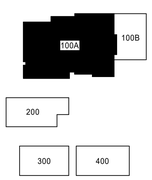
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050204
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
ROOF POWER PLAN - UNIT 100A

SHEET NO.
EP3.1A

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POWER KEYNOTES

R1 ELECTRICAL CONTRACTOR TO INSTALL CORD REELS ON UNDERSIDE OF CEILING JOIST.

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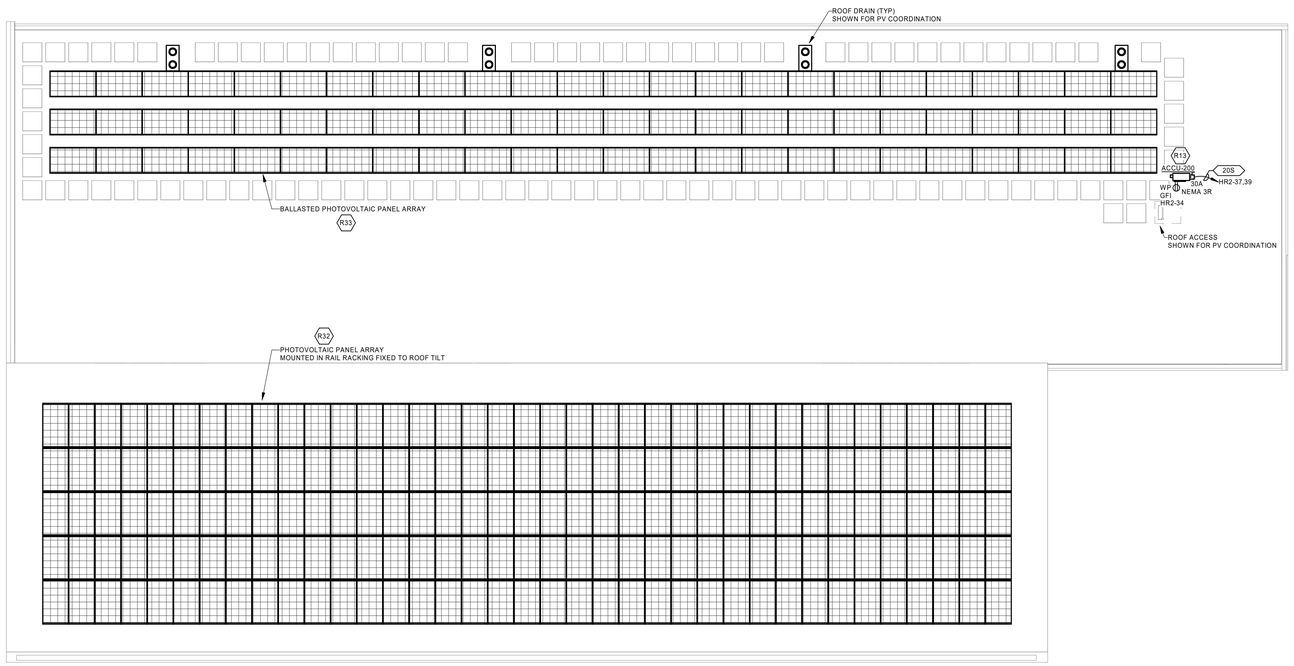
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



ROOF POWER PLAN - UNIT 200
SCALE: 1/8" = 1'-0"

Willow School

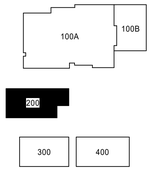
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050103
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
ROOF POWER PLAN - UNIT 200

SHEET NO.
EP3.2

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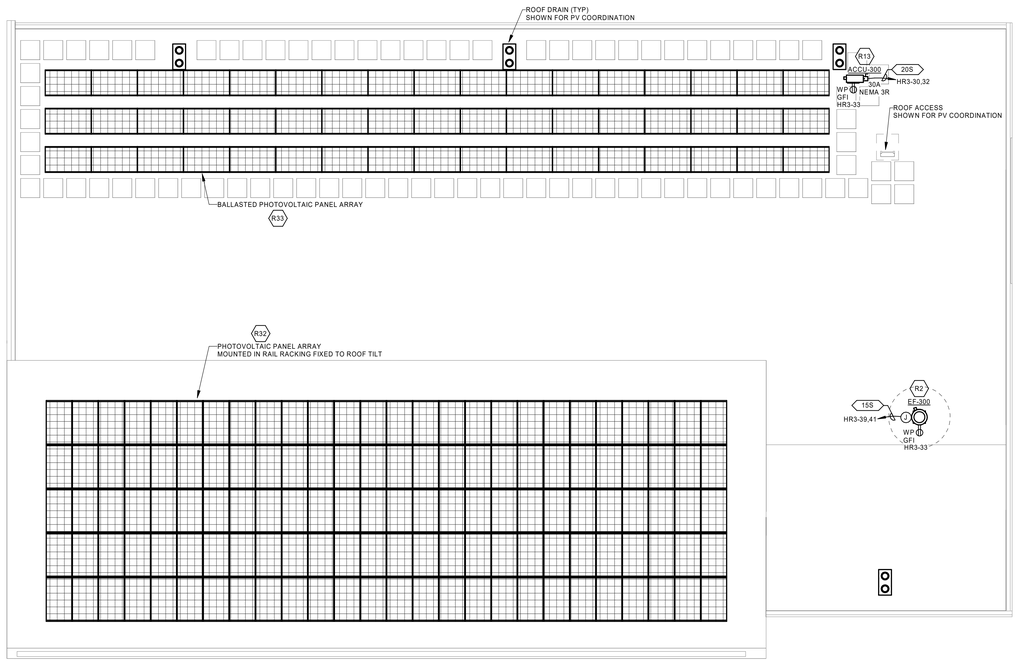
KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK



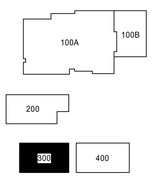
ROOF POWER PLAN - UNIT 300
SCALE: 1/8" = 1'-0"

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 0201065101
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN
LSD NO. SB-0059
JOB NO. 2616.01A
N

SHEET TITLE
ROOF POWER PLAN - UNIT 300

SHEET NO.
EP3.3

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R15 PROVIDE A JUNCTION BOX FOR POWER CONNECTION FOR FOLD-UP DIVIDER BY DRAPER. PROVIDE 3/4" CONDUIT WITH PULLSTRING ROUTED CONCEALED IN WALL FOR REMOTE CONTROLLER IN SWITCH CABINET IN GYMNASIUM. COORDINATE LOCATION OF POWER CONNECTION WITH INSTALLATION MANUALS AND EQUIPMENT PROVIDER PRIOR TO ROUGH-IN.

R16 PROVIDE 2' CONDUIT STUBBED INTO MAIN ELECTRICAL ROOM, ROUTED UNDERGROUND AND STUBBED INTO GREENHOUSE FOR FUTURE USE. PROVIDE WITH PULL STRING. LABEL AND CAP BOTH ENDS.

R17 PROVIDE A STANDARD RECEPTACLE IN A SHALLOW JUNCTION BOX AT THE END OF THE ISLAND. IF GFI PROTECTION IS REQUIRED, PROVIDE VIA UP-STREAM DEVICE OR BREAKER.

POWER KEYNOTES

R18 CONFIRM REQUIRED NEMA CONFIGURATION OF RECEPTACLE, FINAL CIRCUIT BREAKER SIZE, AND WIRE SIZE FOR DRYER RECEPTACLE WITH FINAL SUBMITTAL PRIOR TO INSTALL.

R19 PROVIDE RECEPTACLE FOR MICROWAVE IN CABINET ABOVE EQUIPMENT. COORDINATE FINAL LOCATION AND MOUNTING HEIGHT WITH MANUFACTURER INSTALLATION INSTRUCTIONS AND FINAL MILLWORK DESIGN.

R20 INCOMING TECHNOLOGY CONDUITS TO BE LOCATED DIRECTLY BELOW WALL MOUNTED RACK PROVIDED BY TECHNOLOGY.

R21 CABLE TRAY IN TECHNOLOGY AREAS SHALL BE PROVIDED BY AND INSTALLED BY LOW VOLTAGE. SHOWN FOR REFERENCE ONLY.

R22 LOCATE RECEPTACLE CENTER ON LIGHT FIXTURE ABOVE.

R23 PROVIDE JUNCTION BOXES ON WALL ABOVE WINDOWS FOR POWER CONNECTIONS WHERE INDICATED. ALSO PROVIDE A DUPLEX JUNCTION BOX FOR SWITCH CONTROLLER WHERE INDICATED. COORDINATE FINAL LOCATION OF ALL JUNCTION BOXES WITH ARCHITECTURAL TRADES PRIOR TO ROUGH-IN.

R24 PROVIDE FINAL QUANTITIES OF FLOW AND TAMPER SWITCHES PER FIRE PROTECTION CONTRACTOR. COORDINATE FINAL LOCATION IN FIELD WITH ARCHITECTURAL AND FIRE PROTECTION TRADES.

R25 REFER TO SHEET ES.1 FOR CARD READER DETAILS.

R26 PROVIDE 6-INCH SOLID BOTTOM CABLE TRAY FOR DATA / AV CABLING. MOUNT TO WALL WITH BOTTOM ELEVATION AT 11'-0" AFF. MODIFY RACEWAY IN FIELD TO FIT WALL LENGTH. PROVIDE ALL REQUIRED CONNECTORS, ELBOWS, ETC.

R27 ELECTRICAL CONTRACTOR SHALL COORDINATE IN THE FIELD WITH THE ILLUMINATED BUILDING SIGNAGE EQUIPMENT PROVIDER AND INSTALLER FOR THE LOCATION OF THE SIGNAGE POWER CONNECTION PRIOR TO ROUGH-IN. PROVIDE ADDITIONAL JUNCTION BOXES AS REQUIRED BY SIGNAGE INSTALLER.

POWER KEYNOTES

R28 PROVIDE A EXTRA DEEP JUNCTION BOX FOR LOW VOLTAGE. COORDINATE LOCATION WITH LOW VOLTAGE DRAWINGS AND INSTALLER PRIOR TO ROUGH-IN.

R29 PROVIDE CONDUIT (3) 2" CONDUIT SLEEVES FROM STORAGE ROOMS, THROUGH WALL, STUBBED INTO TRUSS LEVEL OF GYM OR CAFETERIA AND (3) 2" CONDUITS SLEEVES STUBBED INTO CEILING SPACE OF ADJACENT CORRIDOR.

R30 PROVIDE CONDUIT SLEEVES THROUGH FIRE RATED WALL, STUBBED INTO CORRIDOR ABOVE CEILING. ELECTRICAL CONTRACTOR TO MAINTAIN FIRE RATINGS AT WALL PENETRATIONS. LOCATE AT 12'AFF UNLESS NOTED OTHERWISE.
PROVIDE:
A. (2) 2" CONDUIT SLEEVES AT CLASSROOMS CABLE TRAY.
B. (3) 3" CONDUIT SLEEVES AT CABLE TRAY ASSOCIATED WITH POD'S SERVER RACKS.
C. (3) 4" CONDUIT SLEEVES AT MDF 125.
D. (3) 3" CONDUIT SLEEVES AT IDF 154.

R31 (1) 4" CONDUIT FOR LOW VOLTAGE DISTRIBUTION TO PODS. COORDINATE WITH TECHNOLOGY CONSULTANT, CIVIL AND OWNER PRIOR TO ROUGH-IN.

R32 PV ARRAY MOUNTED FIXED TO ROOF WITH UNIRAC RAIL RACKING SYSTEM NXT UMOUNT. PROVIDE SUPPLEMENTAL RACKING CONNECTION COMPONENTS RECOMMENDED BY RACKING MANUFACTURER DUE TO THICKNESS OF TECTUM ROOF DECK. REFER TO RAIL RACKING DETAIL ON PAGE E5.0.

R33 PV ARRAY ON FLAT ROOF TO UTILIZE BALLASTED RACKING SYSTEM UNIRAC RM10. COORDINATE COMPONENTS AND INSTALL WITH RACKING MANUFACTURER.

POWER GENERAL NOTES

1. ALL RECEPTACLES ON EXTERIOR, IN KITCHEN, IN CONCESSION, IN LABORATORY, AND WITHIN 6'-0" OF SINK OR OTHER WATER SUPPLY SHALL BE READILY ACCESSIBLE GFCI TYPE RECEPTACLE.
2. REFER TO ARCHITECTURAL FLOOR PLANS AND ELEVATIONS TO VERIFY LOCATION OF DEVICES.
3. ALL CONDUITS SERVING 120 VOLTS OR GREATER SHALL INCLUDE A GROUND WIRE.
4. ALL CONDUITS SHALL BE ROUTED CONCEALED UNLESS NOTED OTHERWISE.
5. ALL 120 VOLT CIRCUITS SHALL UTILIZE A SEPARATE NEUTRAL.

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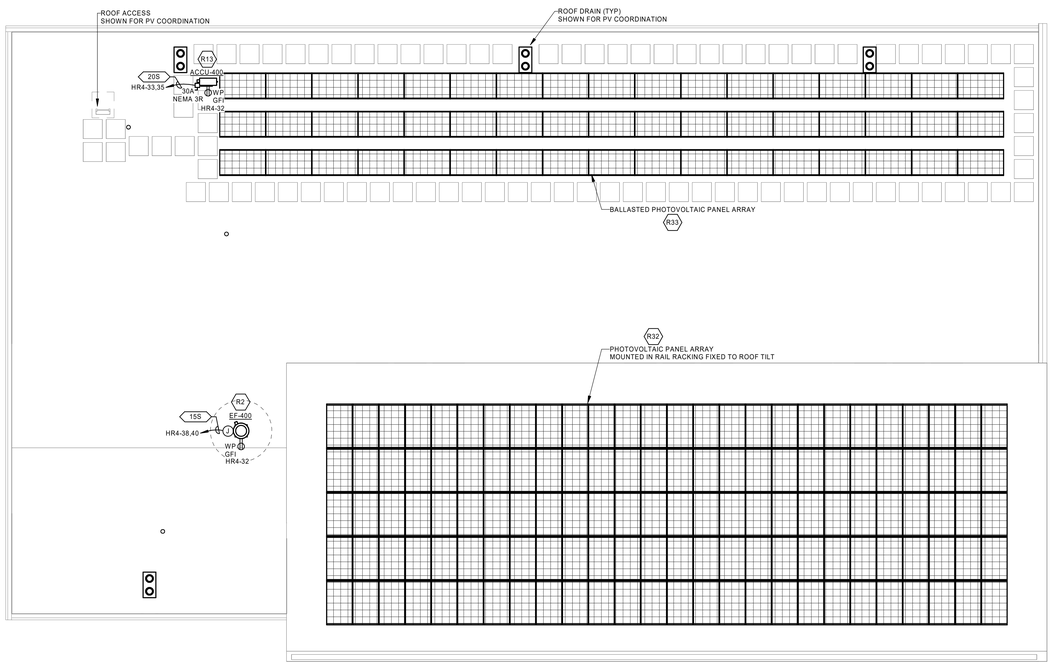


ROOF POWER PLAN - UNIT 400
SCALE: 1/8" = 1'-0"

Willow School

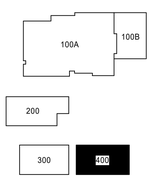
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201065103
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
ROOF POWER PLAN - UNIT 400

SHEET NO.
EP3.4

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SITE PLAN GENERAL NOTES

1. FIELD VERIFY LOCATIONS OF EXISTING UNDERGROUND SERVICES TO COORDINATE ALL POLE BASE LOCATIONS AND UNDERGROUND SERVICES BEING INSTALLED UNDER THIS CONTRACT WITH CIVIL DRAWINGS PRIOR TO INSTALLATION OF POLE BASES AND CONDUIT.

ELECTRICAL SITE PLAN KEYNOTES

S1 PROVIDE ARLINGTON 19.5" LOW-PROFILE ENCLOSURE WITH BUILT-IN COVER, MODEL GDP19B-77020 OR EQUAL.

S2 FROM MANHOLE, DISTRIBUTE (1) 2" CONDUIT TO EACH 200, 300, AND 400 UNIT MAIN MEP ROOM. INCLUDE LOW VOLTAGE DISTRIBUTION CONDUIT IN TRENCH WITH POWER DUCT BANK. INSTALL LOW VOLTAGE CONDUIT MINIMUM 2' FROM POWER CONDUITS IN TRENCH.

S3 PROVIDE (2) 4" CONDUIT UNDERGROUND FROM MDF ROOM TO 5' OUTSIDE BUILDING FOR INCOMING ISP(S). COORDINATE WITH CIVIL DRAWINGS FOR CONTINUATION OF ISP TRENCHING/CONDUITS.

S4 PROVIDE GFCI RATED DUPLEX RECEPTACLE IN HOT BOX STRUCTURE TO POWER ELECTRIC HEATER. REFER TO HOT BOX MANUFACTURER DETAILS FOR INSTALLATION GUIDELINES.

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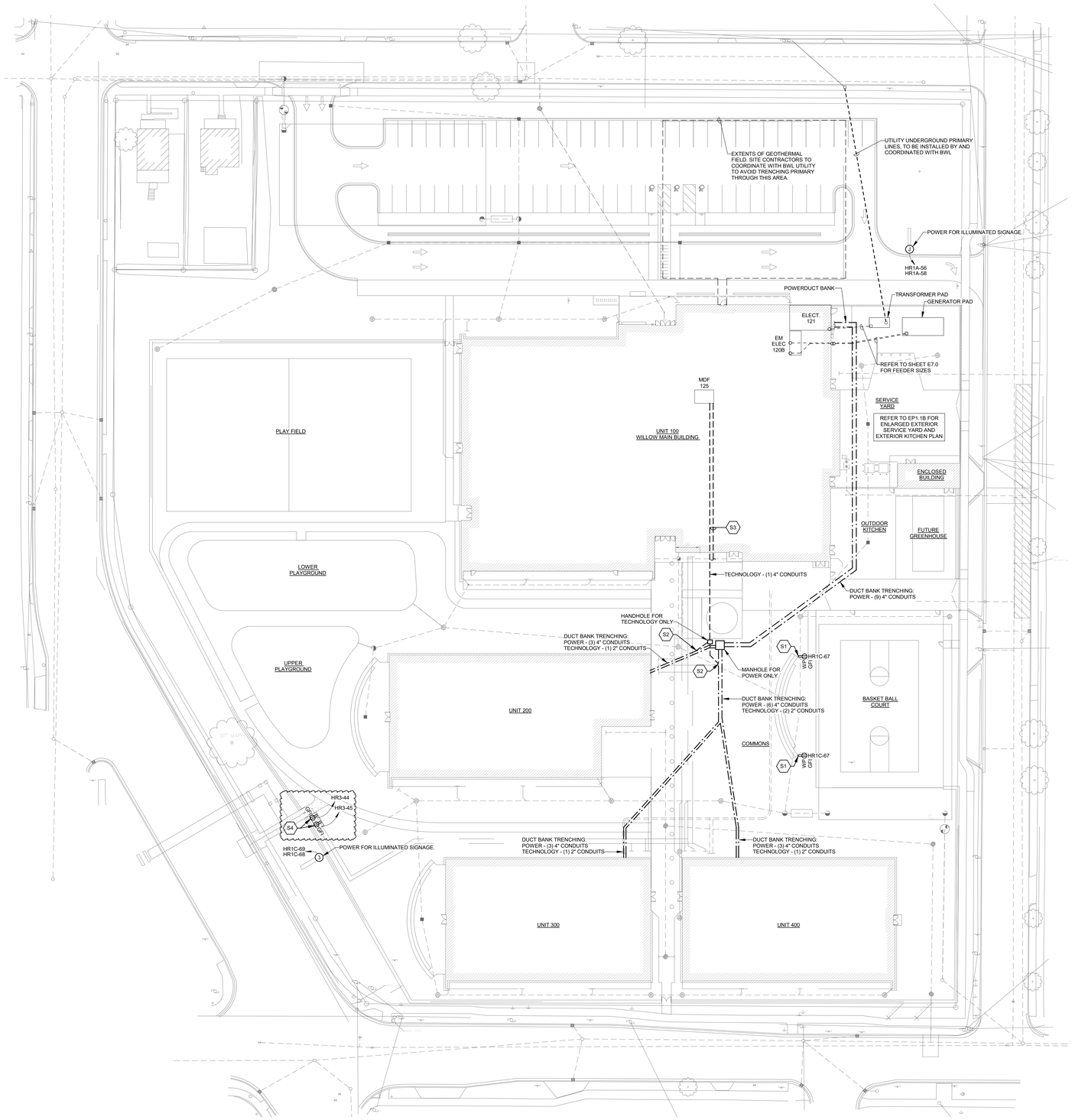


ELECTRICAL SITE POWER PLAN
SCALE: 1" = 30'-0"

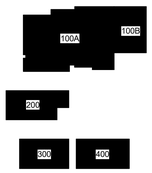
Willow School

Lansing School District

1012 W. Willow
Lansing, MI 48915

Lansing School District

ISSUANC	DAT
Bid and Construction	01.26.2024
Addendum 03	03.15.2024



KEY PLAN

LSD SB-005
JOB 2616.01A
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SHEET
ELECTRICAL SITE POWER PLAN

SHEET
ES1.0

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SITE PLAN GENERAL NOTES

1. FIELD VERIFY LOCATIONS OF EXISTING UNDERGROUND SERVICES TO COORDINATE ALL POLE BASE LOCATIONS AND UNDERGROUND SERVICES BEING INSTALLED UNDER THIS CONTRACT WITH CIVIL DRAWINGS PRIOR TO INSTALLATION OF POLE BASES AND CONDUIT.

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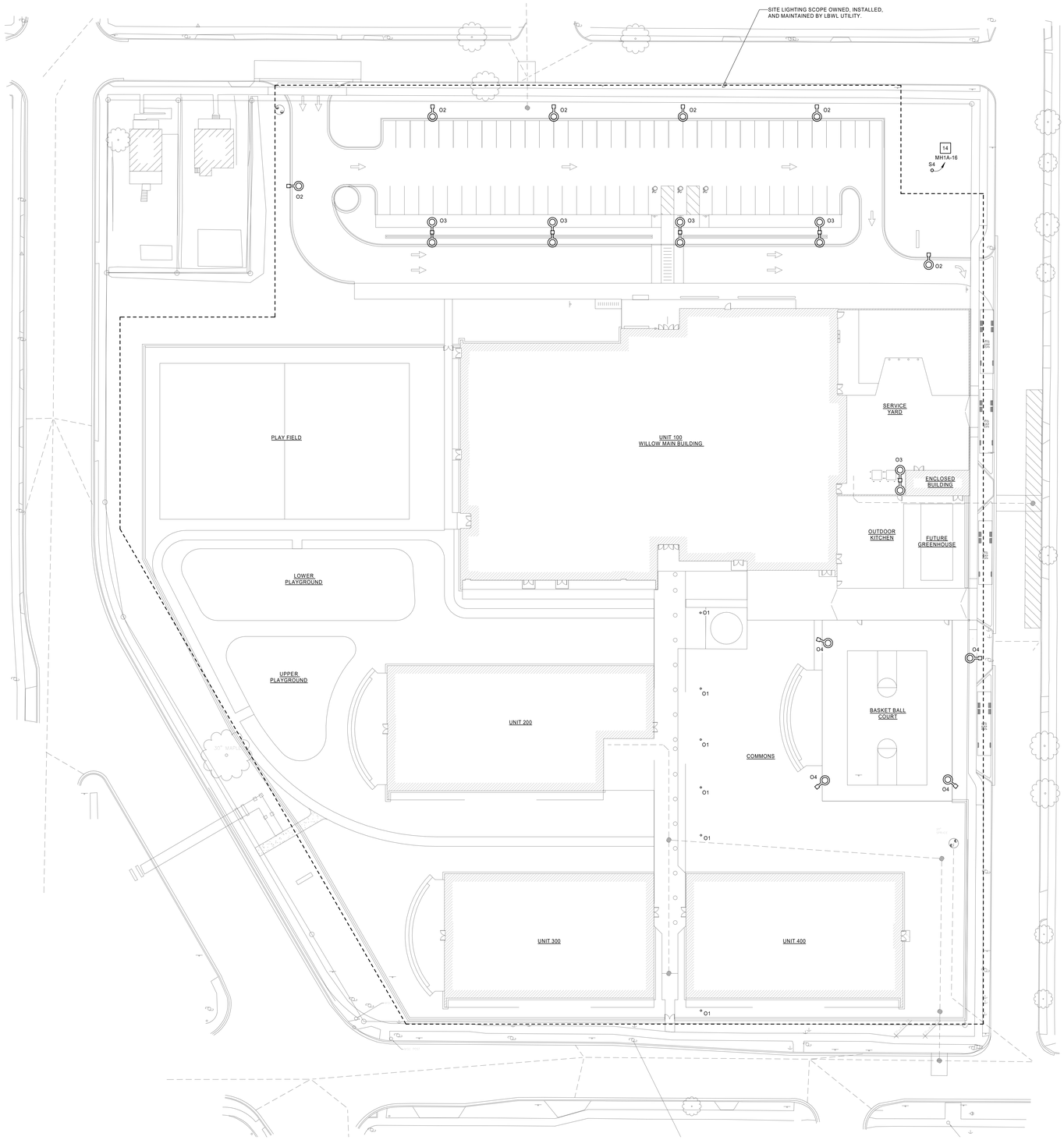


ELECTRICAL SITE LIGHTING PLAN
SCALE: 1" = 30'-0"

Willow School

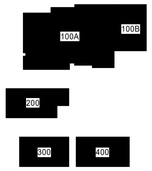
Lansing School District

1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
SCOTT E. TOWNSEND
ENGINEER
No. 6201050102
PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

LSD NO. SB-0059
JOB NO. 2616.01A

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SHEET TITLE
ELECTRICAL SITE LIGHTING PLAN

SHEET NO.
ES1.1

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GENERAL TECHNOLOGY NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. CONTRACTORS SHALL PROVIDE ALL INCIDENTAL MATERIALS AND LABOR FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
2. PRIOR TO BEGINNING WORK, CONTRACTORS ARE TO REVIEW BUILDING PLANS, INSTALLATION LOCATIONS, AND SITE CONDITIONS. NOTIFY THE TECHNOLOGY DESIGNER OF ANY CONDITIONS THAT MAY: PREVENT PROPER INSTALLATION AND OPTIMAL PERFORMANCE OF THE SYSTEMS; VOID THE MANUFACTURER'S WARRANTY; OR THAT CONFLICT WITH THE INTENT OF THE PROJECT. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN RESOLVED. THE CONTRACTOR IS RESPONSIBLE FOR ANY ADDITIONAL WORK RELATED TO CORRECTING UNREPORTED CONFLICTS AND ISSUES, AT NO ADDITIONAL COST TO THE OWNER.
3. FIELD VERIFY LOCATIONS, CONDITIONS AND LENGTHS PRIOR TO INSTALLATION.
4. CONTRACTOR IS REQUIRED TO PROVIDE THEIR OWN PENETRATIONS, SLEEVES, AND CORES THROUGH ALL WALLS AND FLOORS. ALL SLEEVES SHALL HAVE NYLON BUSHINGS.
5. CONTRACTOR SHALL PROVIDE FIRESTOPPING ON PENETRATIONS PASSING THROUGH WALLS AND FLOORS IN WHICH THEY WORK.
6. CONTRACTOR SHALL COORDINATE TELECOMMUNICATION ROOM LAYOUTS WITH ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL COORDINATE ALL EQUIPMENT LOCATIONS AND ROUGH-IN REQUIREMENTS WITH ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATIONS.
8. CONTRACTOR SHALL PROVIDE FACEPLATES AND INSERTS FOR THEIR DEVICES.
9. CONTRACTOR SHALL PROVIDE PROTECTIVE GUARDS ON THEIR DEVICES (CLOCKS, PHONES, ACCESS POINTS, MOTION DETECTORS, ETC.) SUBJECT TO ABUSE IN THE GYMNASIUM.
10. WHEN COLOR / FINISH OPTIONS ARE AVAILABLE, CONTRACTOR SHALL CONFIRM COLOR / FINISH WITH ARCHITECT PRIOR TO ORDERING.

FIBER INFRASTRUCTURE NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. CONTRACTORS SHALL PROVIDE ALL INCIDENTAL MATERIALS AND LABOR FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
2. PRIOR TO BEGINNING WORK, CONTRACTORS ARE TO REVIEW BUILDING PLANS, INSTALLATION LOCATIONS, AND SITE CONDITIONS. NOTIFY THE TECHNOLOGY DESIGNER OF ANY CONDITIONS THAT MAY: PREVENT PROPER INSTALLATION AND OPTIMAL PERFORMANCE OF THE SYSTEMS; VOID THE MANUFACTURER'S WARRANTY; OR THAT CONFLICT WITH THE INTENT OF THE PROJECT. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN RESOLVED. THE CONTRACTOR IS RESPONSIBLE FOR ANY ADDITIONAL WORK RELATED TO CORRECTING UNREPORTED CONFLICTS AND ISSUES, AT NO ADDITIONAL COST TO THE OWNER.
3. FIELD VERIFY LOCATIONS, CONDITIONS AND LENGTHS PRIOR TO INSTALLATION.
4. CONTRACTOR IS REQUIRED TO PROVIDE THEIR OWN PENETRATIONS, SLEEVES, AND CORES THROUGH ALL WALLS AND FLOORS. ALL SLEEVES SHALL HAVE NYLON BUSHINGS.
5. CONTRACTOR SHALL PROVIDE FIRESTOPPING ON PENETRATIONS PASSING THROUGH WALLS AND FLOORS IN WHICH THEY WORK.
6. CONTRACTOR SHALL COORDINATE TELECOMMUNICATION ROOM LAYOUTS WITH BARTON MALOW AND ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL COORDINATE ALL EQUIPMENT LOCATIONS AND ROUGH-IN REQUIREMENTS WITH BARTON MALOW AND ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATIONS.
8. ARMORED SINGLEMODE FIBER SHALL BE USED THROUGHOUT. PROVIDE AND TERMINATE 12 STRANDS FROM MDF TO EACH IDF.

T3 SHEETS - STRUCTURED CABLING

STRUCTURED CABLING COLOR CODE:

- BLUE - GENERAL DATA
- ORANGE - WIRELESS ACCESS
- GREEN - SECURITY

SYMBOL STYLES & ABBREVIATIONS:

CABLING OUTLET / WALL PLATE

- XX — LOCATED IN FLOOR BOX
- XX — LOCATED ON WALL, LOW HEIGHT (18" AFF)
- XX — LOCATED ON WALL, MID HEIGHT (36"-84" AFF)
- XX — LOCATED ON WALL, HIGH HEIGHT (84" + AFF)
- XX — LOCATED AT CEILING

OUTLET / PLATE ABBREVIATIONS

#	NUMBER OF DATA DROPS
WP	WALL PHONE LOCATION, INCLUDE 1 DATA DROP & WALL PHONE PLATE
AP	WIRELESS ACCESS POINT, INCLUDE 1 CAT6A DATA DROP
VS	VIDEO SURVEILLANCE CAMERA LOCATION, INCLUDE 1 DATA DROP
DC	DIGITAL CLOCK LOCATION, INCLUDE 1 DATA DROP
VI	VIDEO INTERCOM LOCATION, INCLUDE 1 DATA DROP
VD	VAPE DETECTOR LOCATION, INCLUDE 1 DATA DROP
SFA	SOUNDFIELD DEVICE LOCATION, INCLUDE 1 DATA DROP

DEVICES:

- AP — WIRELESS ACCESS POINT, CEILING MOUNTED
- AP — WIRELESS ACCESS POINT, WALL MOUNTED

STRUCTURED CABLING PROJECT NOTES:

1. COORDINATE DEVICE DROP LOCATIONS WITH DEVICE INSTALLATION CONTRACTOR. DEVICE INSTALLATION CONTRACTORS SHALL SUPPLY PATCH CABLE FROM THE DEVICE TO THE DATA DROP.
2. CABLING CONTRACTOR TO INSTALL OWNER-PROVIDED WIRELESS ACCESS POINTS. TERMINATE DROPS FOR CLASSROOM AP'S IN THE CORRIDOR. PROVIDE CONDUIT AND PATCH CABLE TO THE AP LOCATION. LABEL AP'S WITH OWNER-PROVIDED AT NUMBER AND THE DATA DROP LABEL.
3. INSTALL OWNER-FURNISHED UPS'S, SWITCHES, AND PHONE EQUIPMENT IN TELECOMMUNICATION ROOM CABINETS. CONTRACTOR OT PATCH ALL TERMINATED PATCH PANEL PORTS 1:1 TO THE SWITCHES. FOLLOW PATCH CABLE COLOR CODING.
4. SIZE UPS's TO ACCOMMODATE PUBLIC ADDRESS SYSTEM COMPONENTS AND AMPLIFIERS CO-LOCATED IN MDF & IDF CABINETS.

T4 SHEETS - CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM

CLOCK SYSTEM DEVICES:

- DC — DIGITAL CLOCK, SINGLE-FACE, WALL MOUNTED
- DC — DIGITAL CLOCK, DOUBLE-FACE, WALL MOUNTED

CLOCK SYSTEM PROJECT NOTES:

1. HEAD END LOCATED IN MDF.
2. ALL CLOCK DEVICES ARE IP / PoE.
3. ALL REQUIRED DATA DROPS PROVIDED BY STRUCTURED CABLING CONTRACTOR.

PUBLIC ADDRESS SYSTEM DEVICES:

- MC — MASTER CONSOLE
- AP — PUBLIC ADDRESS SPEAKER, CEILING MOUNTED, CUT-IN
- PA — PUBLIC ADDRESS SPEAKER, CEILING MOUNTED, PROVIDE ENCLOSURE FOR EXPOSED CEILING
- PA — PUBLIC ADDRESS SPEAKER, WALL MOUNTED
- HN — PUBLIC ADDRESS HORN, WALL MOUNTED
- CB — CALL BUTTON

PUBLIC ADDRESS SYSTEM PROJECT NOTES:

1. HEAD END LOCATED IN MDF.
2. CLASSROOM PA WILL UTILIZE CLASSROOM SOUNDFIELD AUDIO SYSTEM. GYMNASIUM & CAFETERIA SFA WILL FEED MICROPHONE AUDIO TO THE INTEGRATED AUDIO SYSTEM.
3. TAP EACH SPEAKER AT THE FOLLOWING WATTAGE BASED ON SPACE / USE:
   - 3.1. 2 WATTS - SMALL ROOMS AND OFFICES, LESS THAN 200 SQFT.
   - 3.2. 5 WATTS - MEDIUM ROOMS, 200 - 500 SQFT., CORRIDORS
   - 3.3. 15 WATTS - BOILER ROOM HORN
   - 3.4. 30 WATTS - EXTERIOR HORNS & SPEAKERS, GYMNASIUM & CAFETERIA HORNS
4. SIZE AMPLIFIERS WITH 40% ADDITIONAL POWER PER ZONE, ALLOWING FOR 20% ADDITIONAL POWER TAPS AND 20% OVERALL HEADROOM.
5. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

T5 SHEETS - AUDIOVISUAL SYSTEMS

OUTLET STYLES & ABBREVIATIONS:

CABLING OUTLET / WALL PLATE

- XX — LOCATED IN FLOOR BOX
- XX — LOCATED ON WALL, LOW HEIGHT (0"-36" AFF)
- XX — LOCATED ON WALL, MID HEIGHT (36"-84" AFF)
- XX — LOCATED ON WALL, HIGH HEIGHT (84" + AFF)
- XX — LOCATED AT CEILING

OUTLET / PLATE ABBREVIATIONS

T	TEACHER STATION LOCATION: HDMI & USB TO IFP
A	AUDIO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT
V	AUDIO AND/OR VIDEO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT

DEVICES:

- IFP — INTERACTIVE FLAT PANEL, 75" DIAGONAL, WALL MOUNTED
- FP — FLAT PANEL DISPLAY, SIZE AS NOTED, WALL MOUNTED
- DS — DIGITAL SIGNAGE DISPLAY & SIGNAGE PLAYER, SIZE AS NOTED, WALL MOUNTED
- PJ — PROJECTOR, WALL MOUNTED
- SF — SOUNDFIELD SPEAKER, SURFACE-MOUNT STYLE, MOUNTED TO STEEL TRUSS
- SFA — SOUNDFIELD AMPLIFIER LOCATION
- BT — BLUETOOTH RECEIVER LOCATION

AUDIOVISUAL SYSTEMS PROJECT NOTES:

1. ALL IFP'S ARE 75" (CLEVERTOUCH IMPACT PLUS) UNLESS SIZE NOTED OTHERWISE.
2. PROVIDE HEIGHT-ADJUSTABLE WALL MOUNTS FOR IFP'S.
3. INSTALL OWNER-FURNISHED DIGITAL SIGNAGE EQUIPMENT BEHIND ALL DS DISPLAYS.
4. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

T6 SHEETS - ACCESS CONTROL & INTRUSION DETECTION SYSTEM

ACCESS CONTROL SYSTEM DEVICES:

- VI — VIDEO INTERCOM
- VIM — VIDEO INTERCOM MASTER STATION
- CR — CARD READER, WALL MOUNTED
- EH — ELECTRIFIED HARDWARE, REFER TO DOOR HARDWARE SCHEDULE FOR DOORS WITH BUILT-IN CARD READERS

INTRUSION DETECTION SYSTEM DEVICES:

- KP — KEYPAD
- MS — MOTION SENSOR; SHADING INDICATES DIRECTION OF VIEW, NOT COVERAGE
- GS — GLASS BREAK SENSOR

ACCESS CONTROL & INTRUSION DETECTION SYSTEM PROJECT NOTES:

1. CR & EH SYMBOLS SHOWN FOR GENERAL SCOPE AND LOCATIONS ONLY. ALL LOCATIONS MAY NOT BE SHOWN. REFER TO DOOR HARDWARE SCHEDULE FOR ALL LOCATIONS, DETAILS, AND REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, WHAT CABLE TO PULL FOR EACH DOOR, AND WHAT HARDWARE TO INSTALL AT EACH DOOR. OTHER EQUIPMENT (EXAMPLE: INTERCOMS, GLASS BREAK SENSORS), TO BE PROVIDED BY THIS CONTRACTOR.
2. CONTRACTOR TO INSTALL, INTERCONNECT, AND CONFIGURE ADA BUTTONS ON DOORS HAVING ACCESS CONTROL.
3. CONTRACTOR TO PROVIDE AND INSTALL ALL ACCESS CONTROL POWER SUPPLIES.
4. WHEN BUILDING LOCKDOWN IS ENGAGED, ALL DOORS WITH ACCESS CONTROL SHALL LOCK, OVERRIDING ANY SCHEDULE AND PROHIBITING ACCESS FROM MOST CARDS. ONLY STAFF IN AN EMERGENCY ACCESS USER GROUP WILL HAVE ACCESS WITH THEIR CARDS. INTERIOR DOORS ARE TO BE PROGRAMMED WITH A PIN CODE THAT WOULD ONLY BECOME ACTIVE WHEN LOCKDOWN IS ENGAGED. LOCKDOWN MUST ALSO SEND AN EMAIL OR TEXT ALERT TO IDENTIFIED STAFF.
5. CONFIGURE SYSTEM TO SEND ALERTS WHEN EXTERIOR DOORS ARE PROPPED OPEN.
6. CONFIGURE INTRUSION DETECTION SYSTEM TO CALL EPS SECURITY, THE CURRENT MONITORING COMPANY.
7. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

T7 SHEETS - VIDEO SURVEILLANCE SYSTEM

SYMBOL STYLES & ABBREVIATIONS:

- VP — VIDEO SURVEILLANCE CAMERA; SHADING INDICATES DIRECTION OF VIEW, NOT COVERAGE

A	ONE LENS / SENSOR
B	TWO LENS / SENSOR
C	THREE LENS / SENSOR
D	FOUR LENS / SENSOR
F	FISHEYE LENS / SENSOR
#	TOTAL MEGAPIXELS FOR CAMERA; DIVIDE BY NUMBER OF SENSORS FOR *MINIMUM* PER SENSOR
VI	VIDEO INTERCOM STATION (BY ACCESS CONTROL CONTRACTOR); INCLUDE FOR VIDEO RECORDING

PROJECT NOTES:

1. CONFIRM ALL MOUNTING LOCATIONS WITH TECHNOLOGY DESIGNER PRIOR TO INSTALLATION.
2. REVIEW AND CONFIRM ALL CAMERA VIEWS AND SETTINGS WITH TECHNOLOGY DESIGNER AND OWNER PRIOR TO ACCEPTANCE; ADJUST AS NECESSARY.
3. ALL EXTERIOR CAMERAS SHALL BE RATED FOR SUCH USE AND BE PROVIDED WITH HOUSING, HEATER, AND BLOWER AS NECESSARY TO OPERATE IN THE INTENDED CLIMATE.
4. ALL EXTERIOR SINGLE-LENS CAMERAS SHALL DOME-STYLE WITH A SUN SHADE.
5. INCLUDE PENDANT ARM MOUNTS FOR EXTERIOR MULTI-LENS CAMERAS DUE TO FIELD CONDITIONS OR TO OBTAIN THE DESIRED VIEW.
6. VIDEO SURVEILLANCE CONTRACTOR TO PROVIDE PATCH CABLES BETWEEN CAMERA AND DATA JACK SUPPLIED BY OTHERS. COORDINATE JACK LOCATIONS WITH STRUCTURED CABLING CONTRACTOR.
7. THE OWNER'S EXISTING SERVERS WILL BE USED FOR THE ADDITIONAL CAMERAS.
8. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

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T2	COMPOSITE ALL UNITS, FIBER INFRASTRUCTURE
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T3.1B	COMPOSITE UNIT 200, STRUCTURED CABLING
T3.1C	COMPOSITE UNIT 300, STRUCTURED CABLING
T3.1D	COMPOSITE UNIT 400, STRUCTURED CABLING
T4.1A	COMPOSITE UNIT 100, CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM
T4.1B	COMPOSITE UNIT 200, CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM
T4.1C	COMPOSITE UNIT 300, CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM
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T5.1A	COMPOSITE UNIT 100, AUDIOVISUAL SYSTEMS
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T7	SITE PLAN, VIDEO SURVEILLANCE SYSTEM
T7.1A	COMPOSITE UNIT 100, VIDEO SURVEILLANCE SYSTEM
T7.1B	COMPOSITE UNIT 200, VIDEO SURVEILLANCE SYSTEM
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T7.1D	COMPOSITE UNIT 400, VIDEO SURVEILLANCE SYSTEM
T9.1	DETAILS
T9.2	DETAILS
T9.3	DETAILS

N

Barton Malow

Barton Malow Builders
26500 American Drive
Southfield, MI 48034

248.436.5000
www.bartonmalow.com

Owner:

Lansing School District
Lansing, Michigan

Project Number: TBD
Project Manager: Paul Twigg
Drawn By: Bill Dawson
Checked By: Paul Twigg

Issued For	Date
BID & CONSTRUCTION	01/26/2024

Key Plan:

Native Page Size: 42" X 30"

Scale: None

Bid Package SB-0059

Willow School

Technology Systems

T0

Barton Malow

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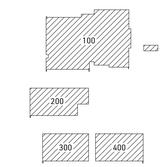

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Scale: 1/32" = 1'

0' 8' 16' 32' 64'

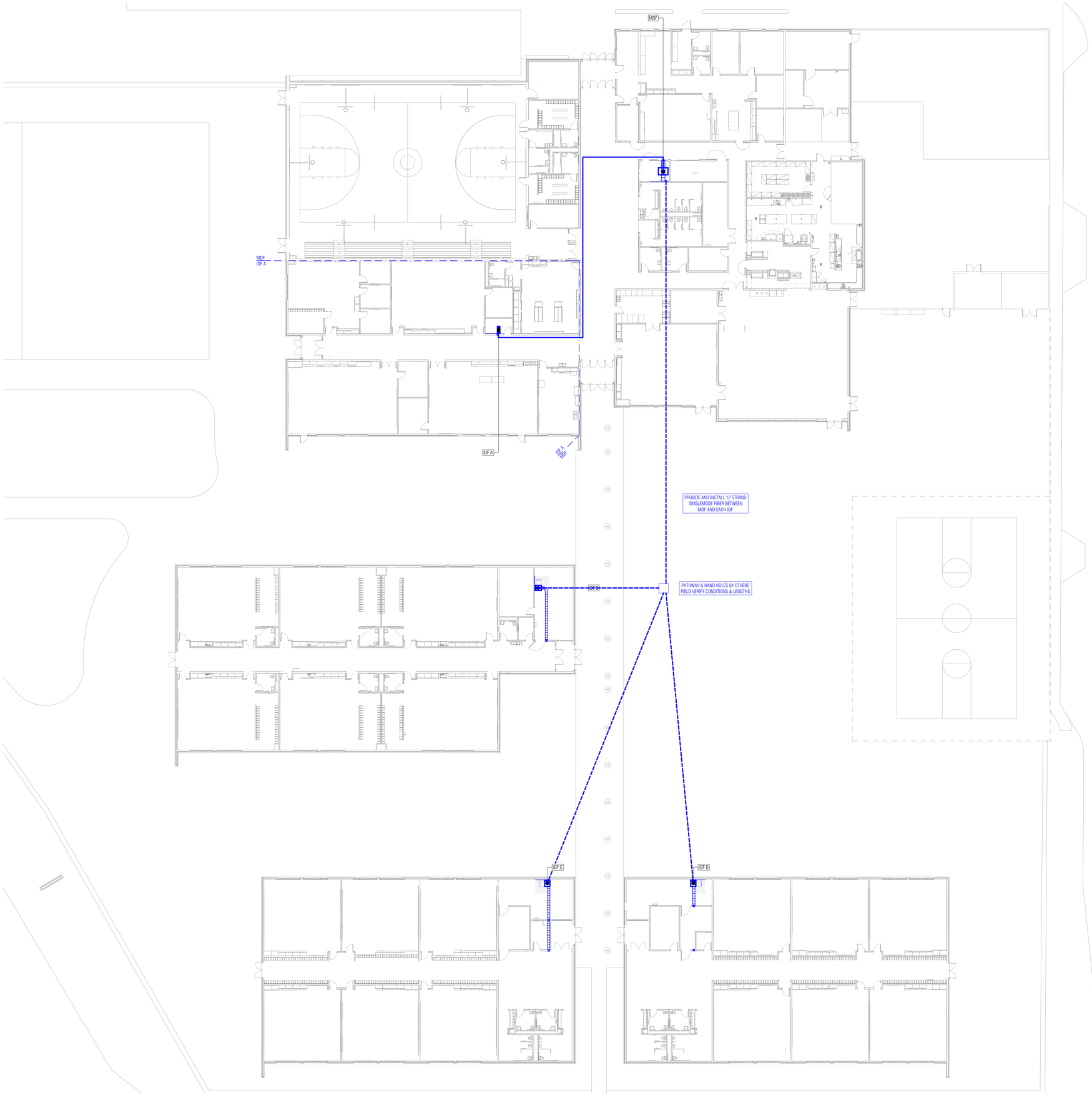
Bid Package SB-0059

Willow School

Site Plan

T1

N



FIBER INFRASTRUCTURE NOTES:

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5. CONTRACTOR SHALL PROVIDE FIRESTOPPING ON PENETRATIONS PASSING THROUGH WALLS AND FLOORS IN WHICH THEY WORK.
6. CONTRACTOR SHALL COORDINATE TELECOMMUNICATION ROOM LAYOUTS WITH BARTON MALOW AND ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL COORDINATE ALL EQUIPMENT LOCATIONS AND ROUGH-IN REQUIREMENTS WITH BARTON MALOW AND ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATIONS.
8. ARMORED SINGLEMODE FIBER SHALL BE USED THROUGHOUT. PROVIDE AND TERMINATE 12 STRANDS FROM MDF TO EACH IDF.

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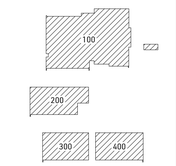

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0' 4' 8' 16' 32'

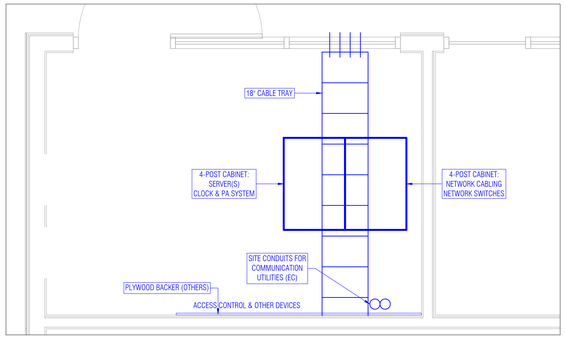
Bid Package SB-0059

Willow School

1st Floor Composite
Fiber Infrastructure

T2

N



MDF Layout
SCALE: 1/2" = 1'

GENERAL TECHNOLOGY NOTES:

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10. WHEN COLOR / FINISH OPTIONS ARE AVAILABLE, CONTRACTOR SHALL CONFIRM COLOR / FINISH WITH ARCHITECT PRIOR TO ORDERING.

T3 SHEETS - STRUCTURED CABLING

STRUCTURED CABLING COLOR CODE:

- BLUE - GENERAL DATA
- ORANGE - WIRELESS ACCESS
- GREEN - SECURITY

SYMBOL STYLES & ABBREVIATIONS:

CABLING OUTLET / WALL PLATE

- XX — LOCATED IN FLOOR BOX
- XX — LOCATED ON WALL, LOW HEIGHT (18" AFF)
- XX — LOCATED ON WALL, MID HEIGHT (36"-84" AFF)
- XX — LOCATED ON WALL, HIGH HEIGHT (84"+ AFF)
- XX — LOCATED AT CEILING

OUTLET / PLATE ABBREVIATIONS

#	NUMBER OF DATA DROPS
WP	WALL PHONE LOCATION, INCLUDE 1 DATA DROP & WALL PHONE PLATE
AP	WIRELESS ACCESS POINT, INCLUDE 1 CAT6A DATA DROP
VS	VIDEO SURVEILLANCE CAMERA LOCATION, INCLUDE 1 DATA DROP
DC	DIGITAL CLOCK LOCATION, INCLUDE 1 DATA DROP
VI	VIDEO INTERCOM LOCATION, INCLUDE 1 DATA DROP
VD	VAPE DETECTOR LOCATION, INCLUDE 1 DATA DROP
SFA	SOUNDFIELD DEVICE LOCATION, INCLUDE 1 DATA DROP

DEVICES:

- AP — WIRELESS ACCESS POINT, CEILING MOUNTED
- AP — WIRELESS ACCESS POINT, WALL MOUNTED

STRUCTURED CABLING PROJECT NOTES:

1. COORDINATE DEVICE DROP LOCATIONS WITH DEVICE INSTALLATION CONTRACTOR. DEVICE INSTALLATION CONTRACTORS SHALL SUPPLY PATCH CABLE FROM THE DEVICE TO THE DATA DROP.
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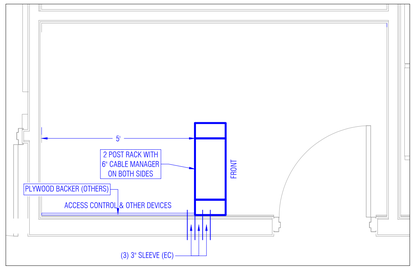
4. SIZE UPS's TO ACCOMMODATE PUBLIC ADDRESS SYSTEM COMPONENTS AND AMPLIFIERS CO-LOCATED IN MDF & IDF CABINETS.



IDF A Layout
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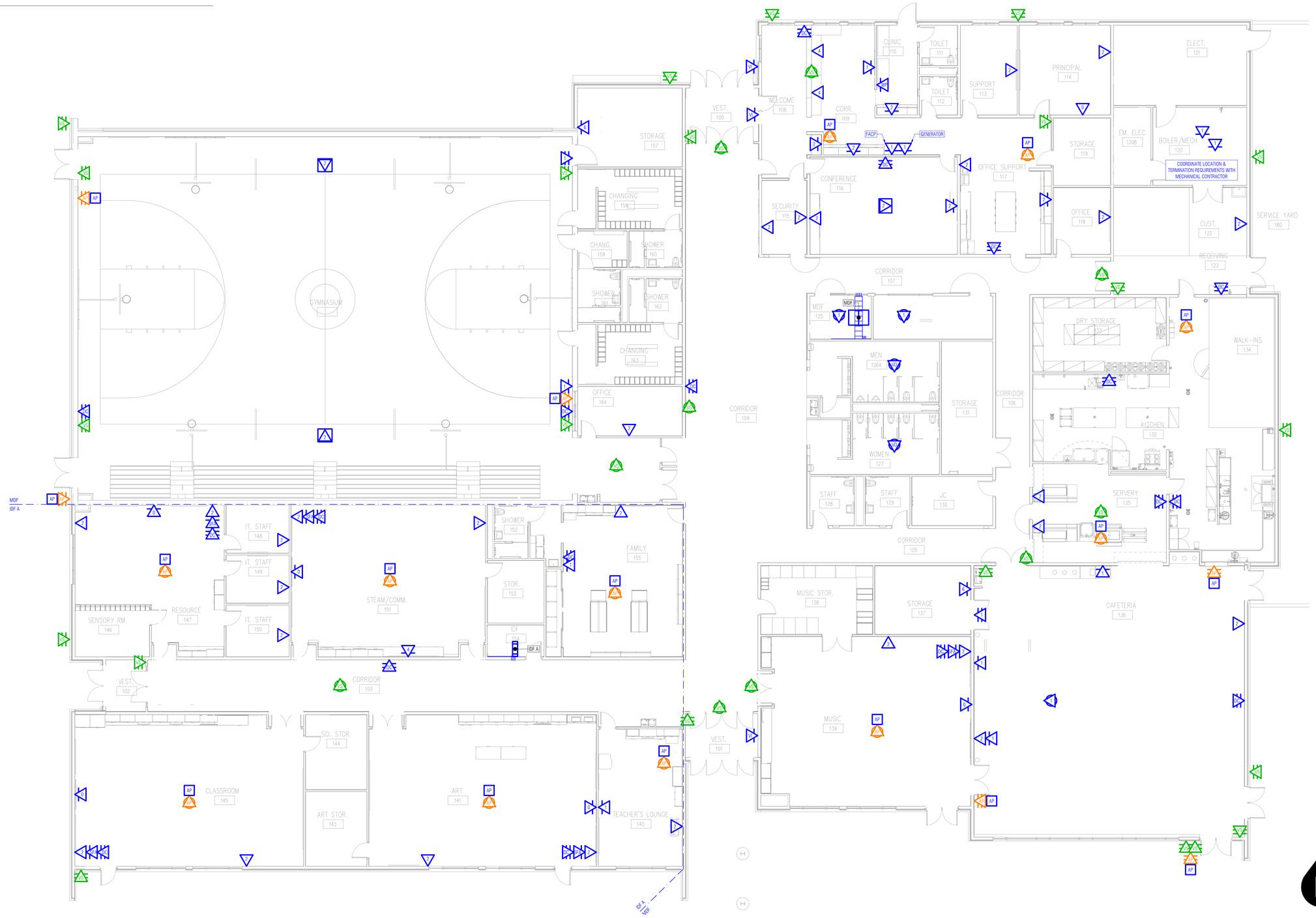

N

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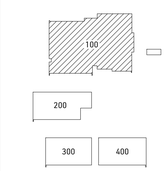

Native Page Size: 42" X 30"

Scale: 1/8" = 1'
0' 2' 4' 8' 16'

Bid Package SB-0059

Willow School

Unit 100
Structured Cabling

T3.1A

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T3 SHEETS - STRUCTURED CABLING

STRUCTURED CABLING COLOR CODE:

- BLUE - GENERAL DATA
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CABLING OUTLET / WALL PLATE

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SFA	SOUNDFIELD DEVICE LOCATION, INCLUDE 1 DATA DROP

DEVICES:

- AP — WIRELESS ACCESS POINT, CEILING MOUNTED
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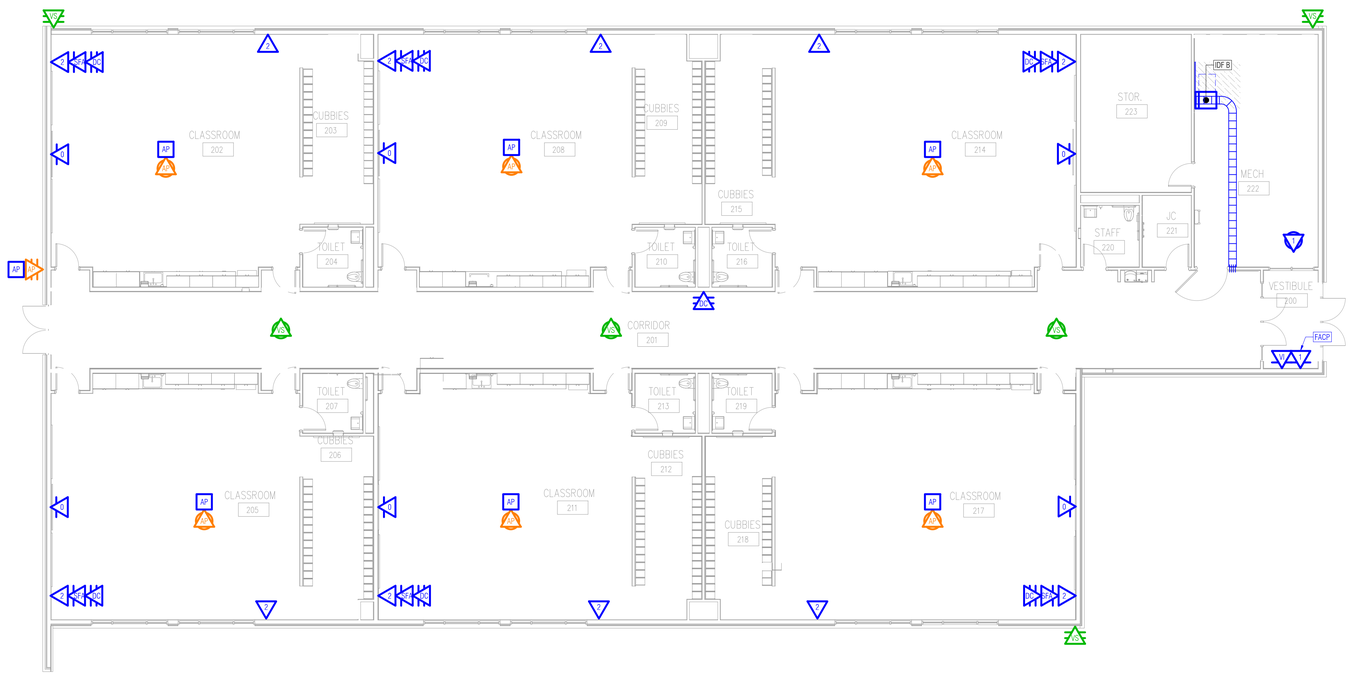

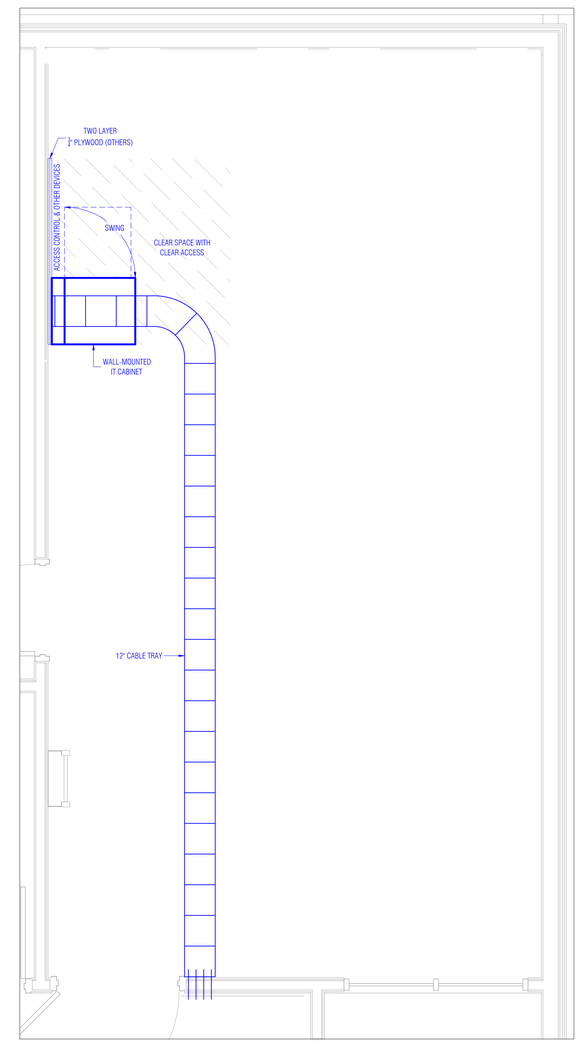

IDF B Layout
SCALE: 1/2" = 1'

N

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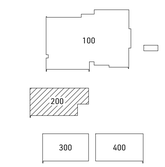
Key Plan:



Native Page Size: 42" X 30"

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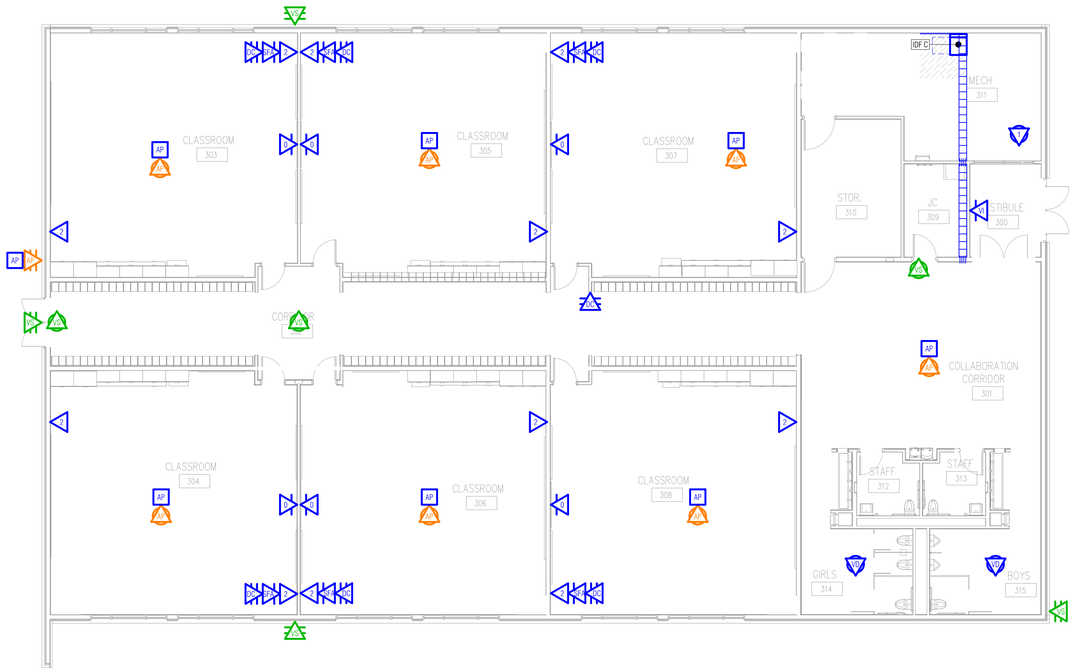
0' 2' 4' 8' 16'

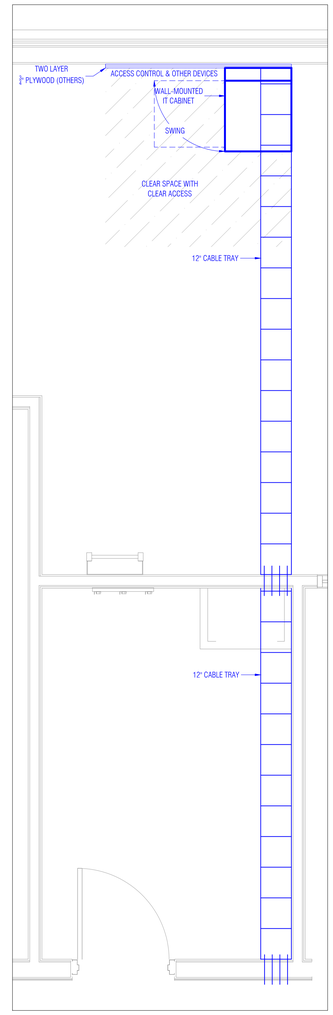
Bid Package SB-0059

Willow School

Unit 200
Structured Cabling

T3.1B





IDF C Layout
SCALE: 1/2" = 1'

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T3 SHEETS - STRUCTURED CABLING

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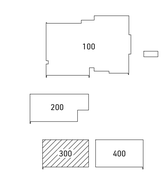

Native Page Size: 42" X 30"

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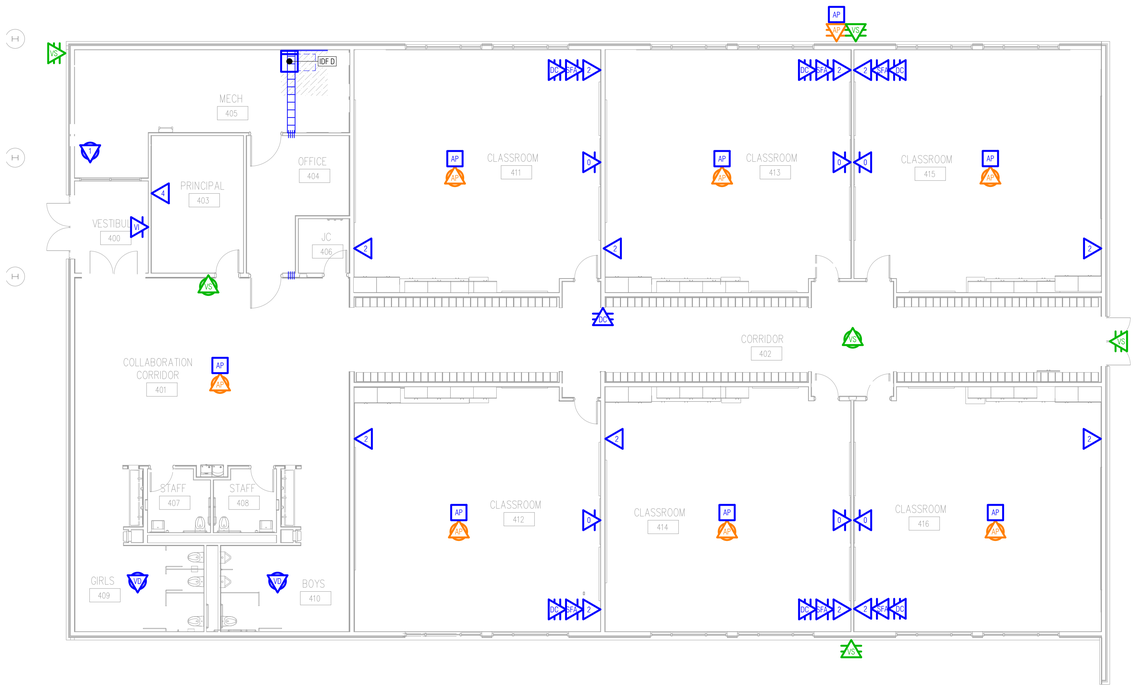
Bid Package SB-0059

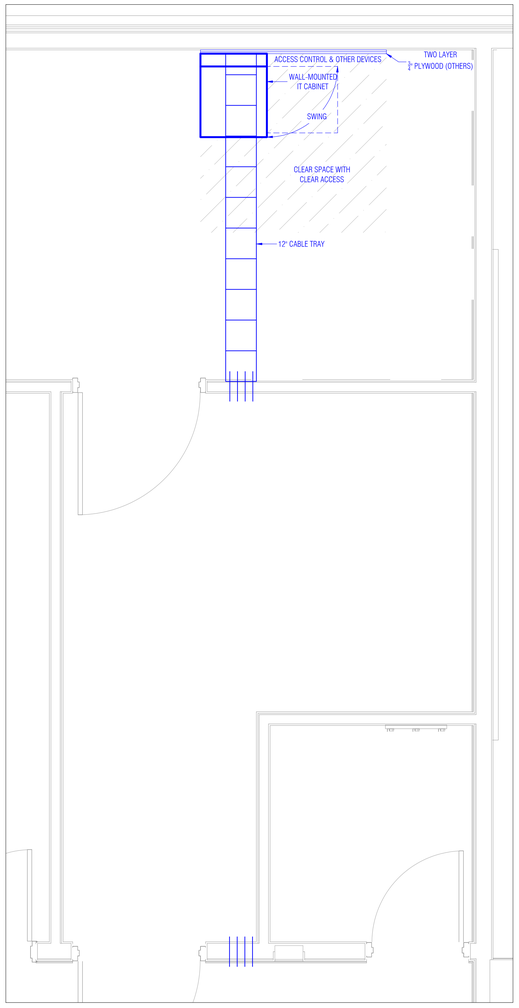
Willow School

Unit 300
Structured Cabling

N

T3.1C





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#	NUMBER OF DATA DROPS
WP	WALL PHONE LOCATION, INCLUDE 1 DATA DROP & WALL PHONE PLATE
AP	WIRELESS ACCESS POINT, INCLUDE 1 CAT6A DATA DROP
VS	VIDEO SURVEILLANCE CAMERA LOCATION, INCLUDE 1 DATA DROP
DC	DIGITAL CLOCK LOCATION, INCLUDE 1 DATA DROP
VI	VIDEO INTERCOM LOCATION, INCLUDE 1 DATA DROP
VD	VAPE DETECTOR LOCATION, INCLUDE 1 DATA DROP
SFA	SOUNDFIELD DEVICE LOCATION, INCLUDE 1 DATA DROP

DEVICES:

- AP — WIRELESS ACCESS POINT, CEILING MOUNTED
- AP — WIRELESS ACCESS POINT, WALL MOUNTED

STRUCTURED CABLING PROJECT NOTES:

1. COORDINATE DEVICE DROP LOCATIONS WITH DEVICE INSTALLATION CONTRACTOR. DEVICE INSTALLATION CONTRACTORS SHALL SUPPLY PATCH CABLE FROM THE DEVICE TO THE DATA DROP.
2. CABLING CONTRACTOR TO INSTALL OWNER-PROVIDED WIRELESS ACCESS POINTS. TERMINATE DROPS FOR CLASSROOM AP'S IN THE CORRIDOR. PROVIDE CONDUIT AND PATCH CABLE TO THE AP LOCATION. LABEL AP'S WITH OWNER-PROVIDED AT NUMBER AND THE DATA DROP LABEL.
3. INSTALL OWNER-FURNISHED UPS'S, SWITCHES, AND PHONE EQUIPMENT IN TELECOMMUNICATION ROOM CABINETS. CONTRACTOR OT PATCH ALL TERMINATED PATCH PANEL PORTS 1:1 TO THE SWITCHES. FOLLOW PATCH CABLE COLOR CODING.
4. SIZE UPS'S TO ACCOMMODATE PUBLIC ADDRESS SYSTEM COMPONENTS AND AMPLIFIERS CO-LOCATED IN MDF & IDF CABINETS.

Barton Malow

Barton Malow Builders
26500 American Drive
Southfield, MI 48034

248.436.5000
www.bartonmalow.com

Owner:

Lansing School District
Lansing, Michigan

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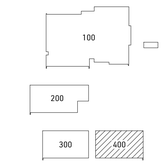
Project Manager: Paul Twigg
Drawn By: Bill Dawson
Checked By: Paul Twigg

Issued For	Date
BID & CONSTRUCTION	01/26/2024

Key Plan:



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0' 2' 4' 8' 16'

Bid Package SB-0059

Willow School

Unit 400
Structured Cabling

N

T3.1D

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10. WHEN COLOR / FINISH OPTIONS ARE AVAILABLE, CONTRACTOR SHALL CONFIRM COLOR / FINISH WITH ARCHITECT PRIOR TO ORDERING.

T4 SHEETS - CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM

CLOCK SYSTEM DEVICES:

- DC — DIGITAL CLOCK, SINGLE-FACE, WALL MOUNTED
- DC — DIGITAL CLOCK, DOUBLE-FACE, WALL MOUNTED

CLOCK SYSTEM PROJECT NOTES:

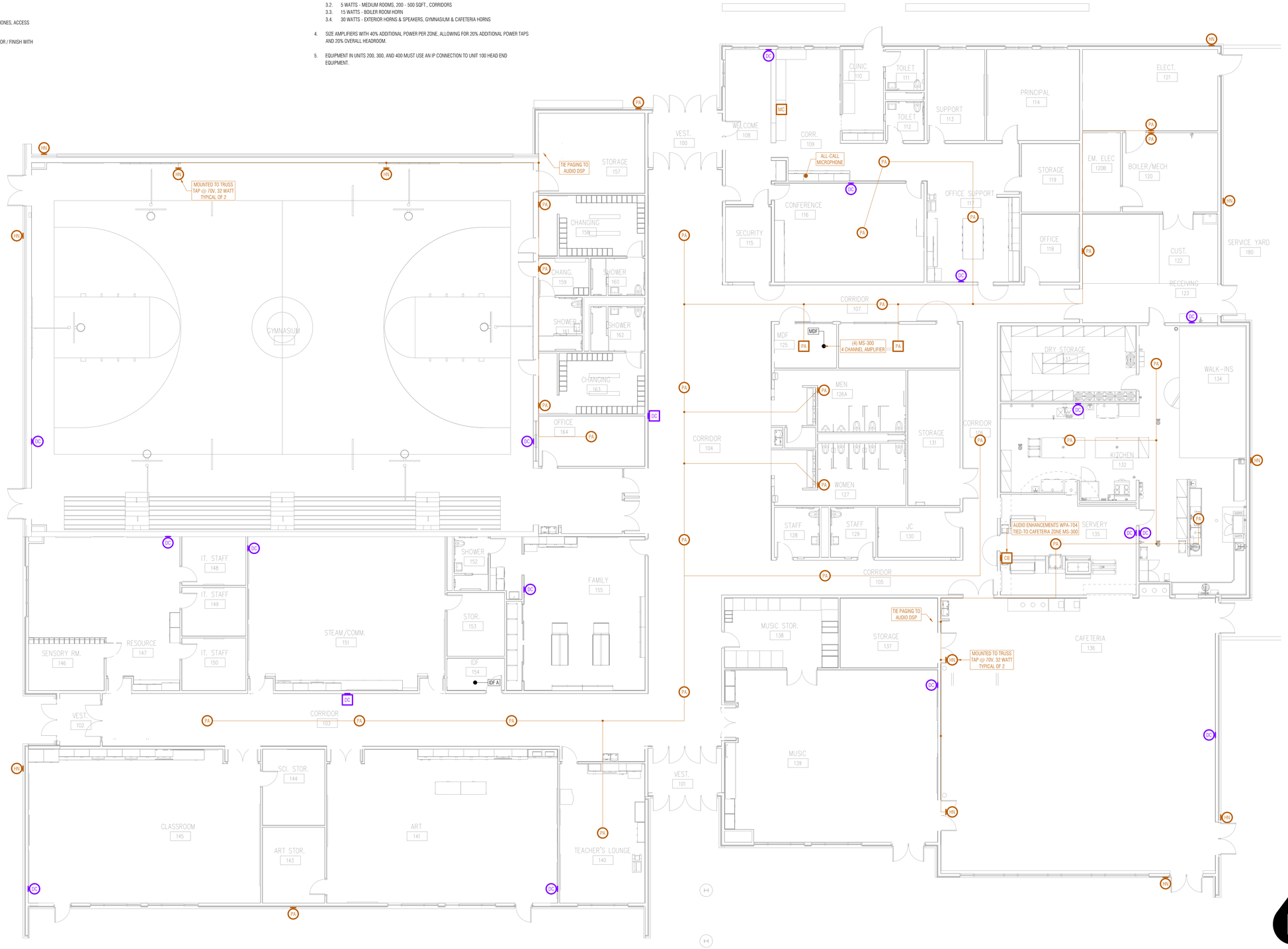
1. HEAD END LOCATED IN MDF.
2. ALL CLOCK DEVICES ARE IP / PoE.
3. ALL REQUIRED DATA DROPS PROVIDED BY STRUCTURED CABLING CONTRACTOR.

PUBLIC ADDRESS SYSTEM DEVICES:

- MC — MASTER CONSOLE
- PA — PUBLIC ADDRESS SPEAKER, CEILING MOUNTED, CUT-IN
- PA — PUBLIC ADDRESS SPEAKER, CEILING MOUNTED, PROVIDE ENCLOSURE FOR EXPOSED CEILING
- PA — PUBLIC ADDRESS SPEAKER, WALL MOUNTED
- HN — PUBLIC ADDRESS HORN, WALL MOUNTED
- CB — CALL BUTTON

PUBLIC ADDRESS SYSTEM PROJECT NOTES:

1. HEAD END LOCATED IN MDF.
2. CLASSROOM PA WILL UTILIZE CLASSROOM SOUNDFIELD AUDIO SYSTEM. GYMNASIUM & CAFETERIA SFA WILL FEED MICROPHONE AUDIO TO THE INTEGRATED AUDIO SYSTEM.
3. TAP EACH SPEAKER AT THE FOLLOWING WATTAGE BASED ON SPACE / USE:
   - 3.1. 2 WATTS - SMALL ROOMS AND OFFICES, LESS THAN 200 SQFT.
   - 3.2. 5 WATTS - MEDIUM ROOMS, 200 - 500 SQFT., CORRIDORS
   - 3.3. 15 WATTS - BOILER ROOM HORN
   - 3.4. 30 WATTS - EXTERIOR HORNS & SPEAKERS, GYMNASIUM & CAFETERIA HORNS
4. SIZE AMPLIFIERS WITH 40% ADDITIONAL POWER PER ZONE, ALLOWING FOR 20% ADDITIONAL POWER TAPS AND 20% OVERALL HEADROOM.
5. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.



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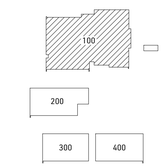

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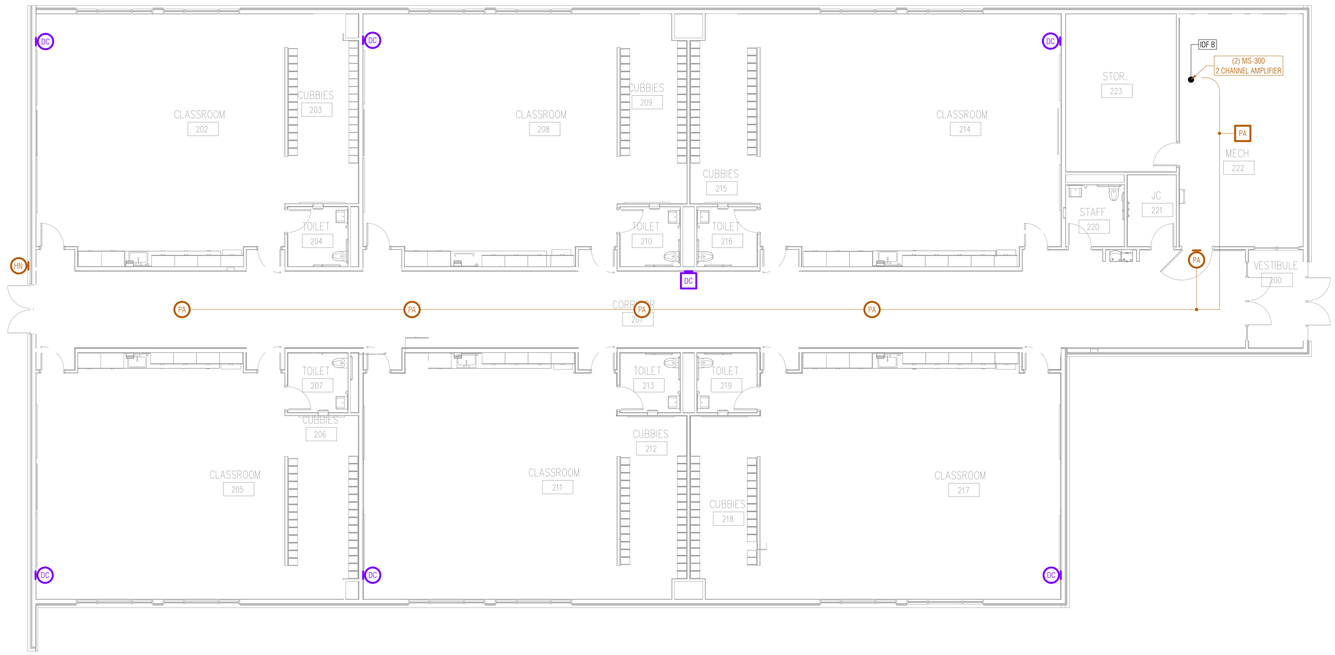
Bid Package SB-0059

Willow School

Unit 100
Clock System
Public Address System

T4.1A



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T4 SHEETS - CLOCK SYSTEM & PUBLIC ADDRESS SYSTEM

CLOCK SYSTEM DEVICES:

- DC — DIGITAL CLOCK, SINGLE-FACE, WALL MOUNTED
- DS — DIGITAL CLOCK, DOUBLE-FACE, WALL MOUNTED

CLOCK SYSTEM PROJECT NOTES:

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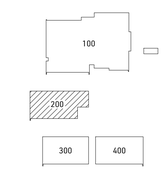

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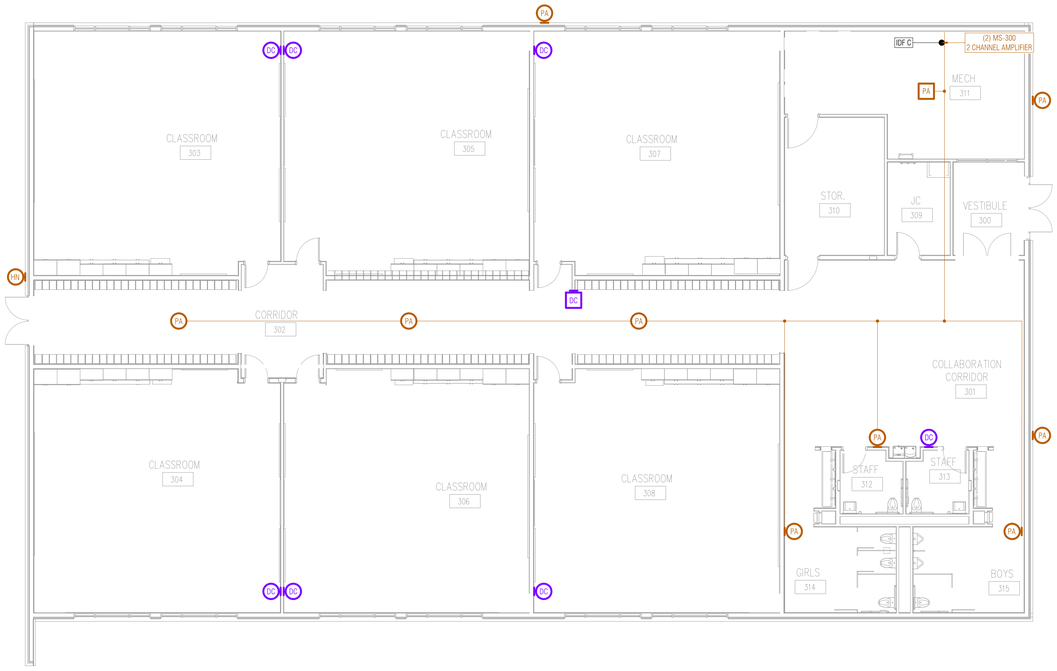
Bid Package SB-0059

Willow School

Unit 200
Clock System
Public Address System

N

T4.1B



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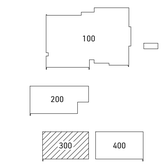

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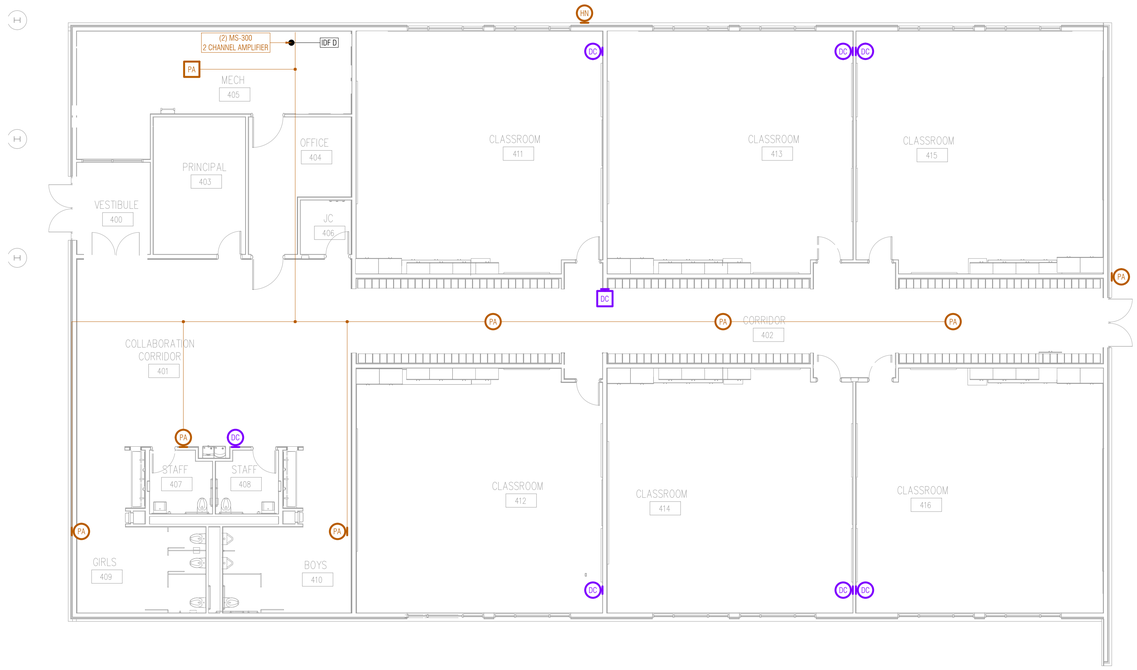
Bid Package SB-0059

Willow School

Unit 300
Clock System
Public Address System

N

T4.1C



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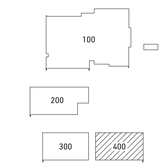

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Willow School

Unit 400
Clock System
Public Address System

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T5 SHEETS - AUDIOVISUAL SYSTEMS

OUTLET STYLES & ABBREVIATIONS:

CABLING OUTLET / WALL PLATE

- LOCATED IN FLOOR BOX
- LOCATED ON WALL, LOW HEIGHT (0"-36" AFF)
- LOCATED ON WALL, MID HEIGHT (36"-84" AFF)
- LOCATED ON WALL, HIGH HEIGHT (84"+ AFF)
- LOCATED AT CEILING

OUTLET / PLATE ABBREVIATIONS

T TEACHER STATION LOCATION: HDMI & USB TO IFP
A AUDIO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT
V AUDIO AND/OR VIDEO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT

DEVICES:

- IFP INTERACTIVE FLAT PANEL, 75" DIAGONAL, WALL MOUNTED
- FP FLAT PANEL DISPLAY, SIZE AS NOTED, WALL MOUNTED
- DS DIGITAL SIGNAGE DISPLAY & SIGNAGE PLAYER, SIZE AS NOTED, WALL MOUNTED
- PJ PROJECTOR, WALL MOUNTED
- SF SOUNDFIELD SPEAKER, SURFACE-MOUNT STYLE, MOUNTED TO STEEL TRUSS
- SFA SOUNDFIELD AMPLIFIER LOCATION
- BT BLUETOOTH RECEIVER LOCATION

AUDIOVISUAL SYSTEMS PROJECT NOTES:

1. ALL IFP'S ARE 75" (CLEVERTOUCH IMPACT PLUS) UNLESS SIZE NOTED OTHERWISE.
2. PROVIDE HEIGHT-ADJUSTABLE WALL MOUNTS FOR IFP'S.
3. INSTALL OWNER-FURNISHED DIGITAL SIGNAGE EQUIPMENT BEHIND ALL DS DISPLAYS.
4. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

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Southfield, MI 48034

248.436.5000
www.bartonmalow.com

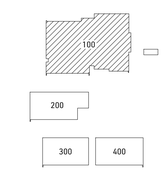
Owner:

Lansing School District
Lansing, Michigan

Project Number: TBD
Project Manager: Paul Twigg
Drawn By: Bill Dawson
Checked By: Paul Twigg

Issued For	Date
BID & CONSTRUCTION	01/26/2024

Key Plan:



Native Page Size: 42" X 30"

Scale: 1/8" = 1'

0' 2' 4' 8' 16'

Bid Package SB-0059

Willow School

Unit 100
Audiovisual Systems

T5.1A

GENERAL TECHNOLOGY NOTES:

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T5 SHEETS - AUDIOVISUAL SYSTEMS

OUTLET STYLES & ABBREVIATIONS:

CABLING OUTLET / WALL PLATE

- LOCATED IN FLOOR BOX
- LOCATED ON WALL, LOW HEIGHT (0'-36" AFF)
- LOCATED ON WALL, MID HEIGHT (36"-84" AFF)
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- LOCATED AT CEILING

OUTLET / PLATE ABBREVIATIONS

T TEACHER STATION LOCATION: HDMI & USB TO IFP
A AUDIO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT
V AUDIO AND/OR VIDEO INPUT LOCATION - SEE SCHEMATIC OR CALLOUT

DEVICES:

- IFP INTERACTIVE FLAT PANEL, 75" DIAGONAL, WALL MOUNTED
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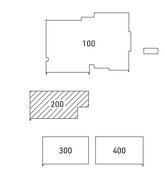

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Bid Package SB-0059

Willow School

Unit 200
Audiovisual Systems

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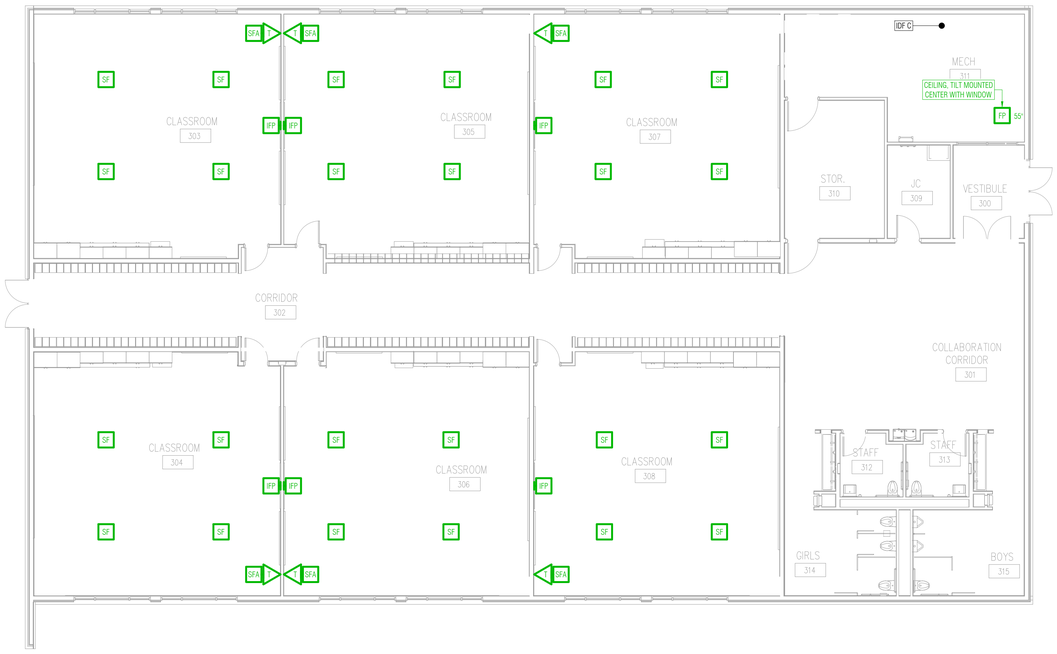
T5.1B



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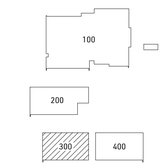

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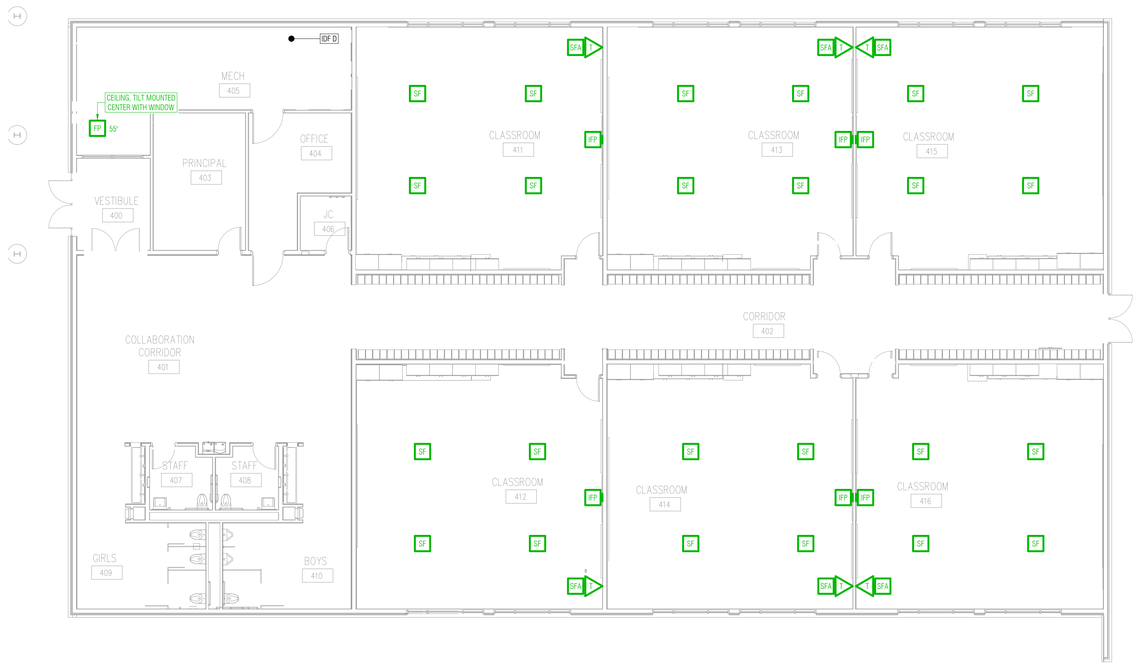
Willow School

Unit 300
Audiovisual Systems

N

T5.1C



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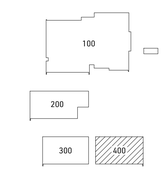

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0' 2' 4' 8' 16'

Bid Package SB-0059

Willow School

Unit 400
Audiovisual Systems

N

T5.1D

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T6 SHEETS - ACCESS CONTROL & INTRUSION DETECTION SYSTEM

ACCESS CONTROL SYSTEM DEVICES:

- VI — VIDEO INTERCOM
- VIM — VIDEO INTERCOM MASTER STATION
- CR — CARD READER, WALL MOUNTED
- EH — ELECTRIFIED HARDWARE, REFER TO DOOR HARDWARE SCHEDULE FOR DOORS WITH BUILT-IN CARD READERS

INTRUSION DETECTION SYSTEM DEVICES:

- KP — KEYPAD
- MS — MOTION SENSOR; SHADING INDICATES DIRECTION OF VIEW, NOT COVERAGE
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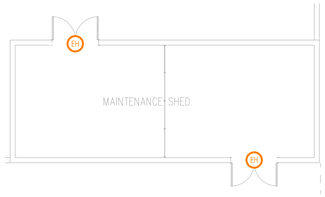
6. CONFIGURE INTRUSION DETECTION SYSTEM TO CALL EPS SECURITY, THE CURRENT MONITORING



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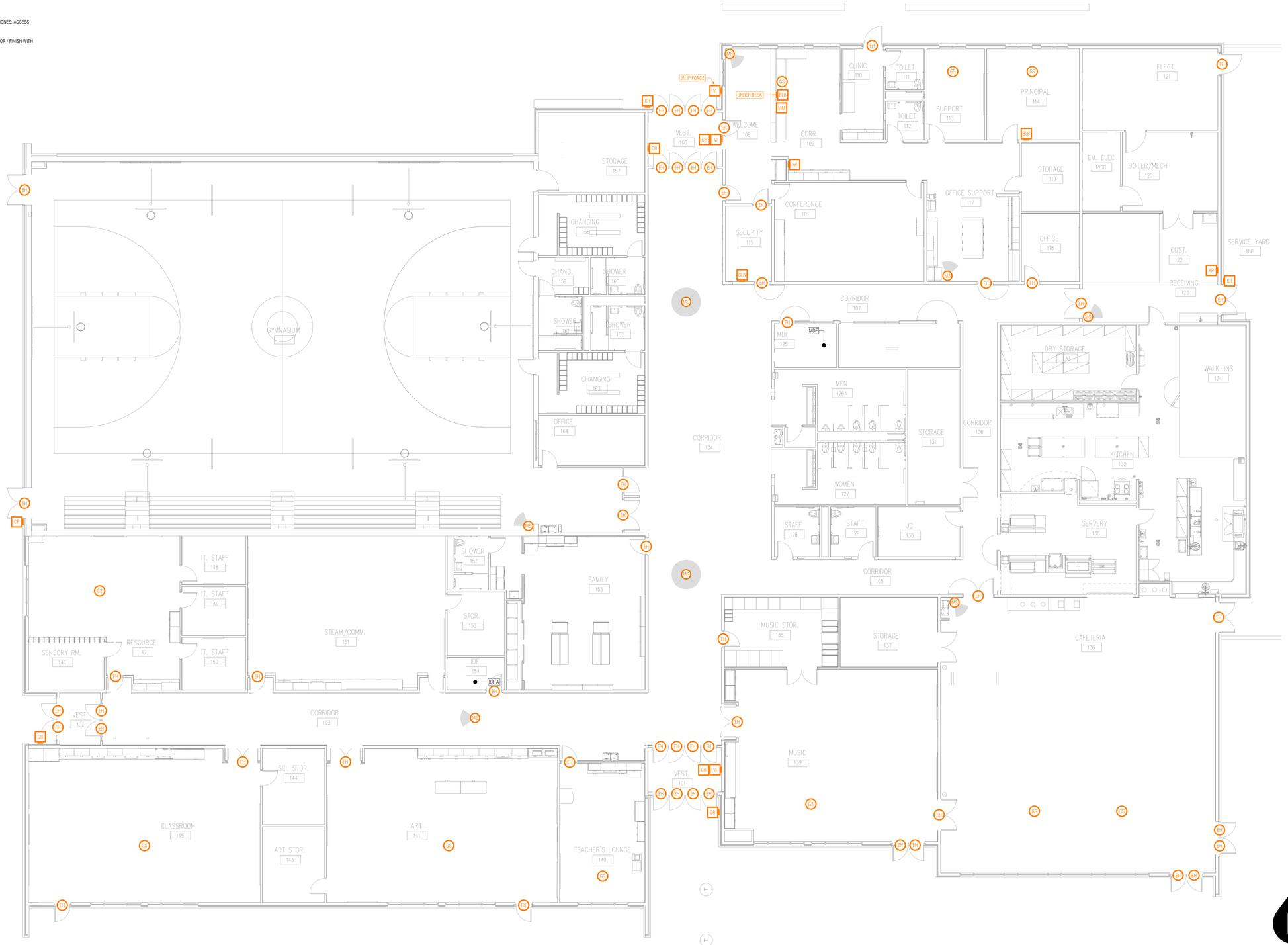

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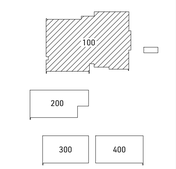

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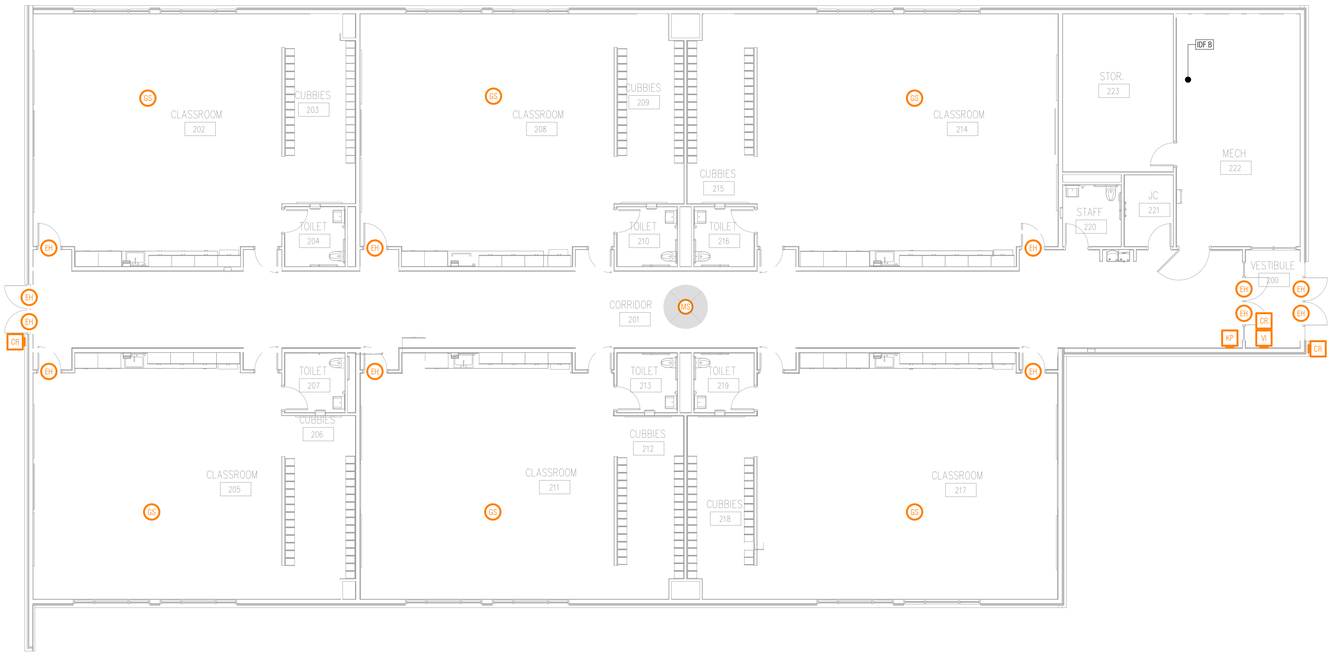
Bid Package SB-0059

Willow School

Unit 100
Access Control System

T6.1A



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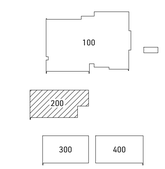

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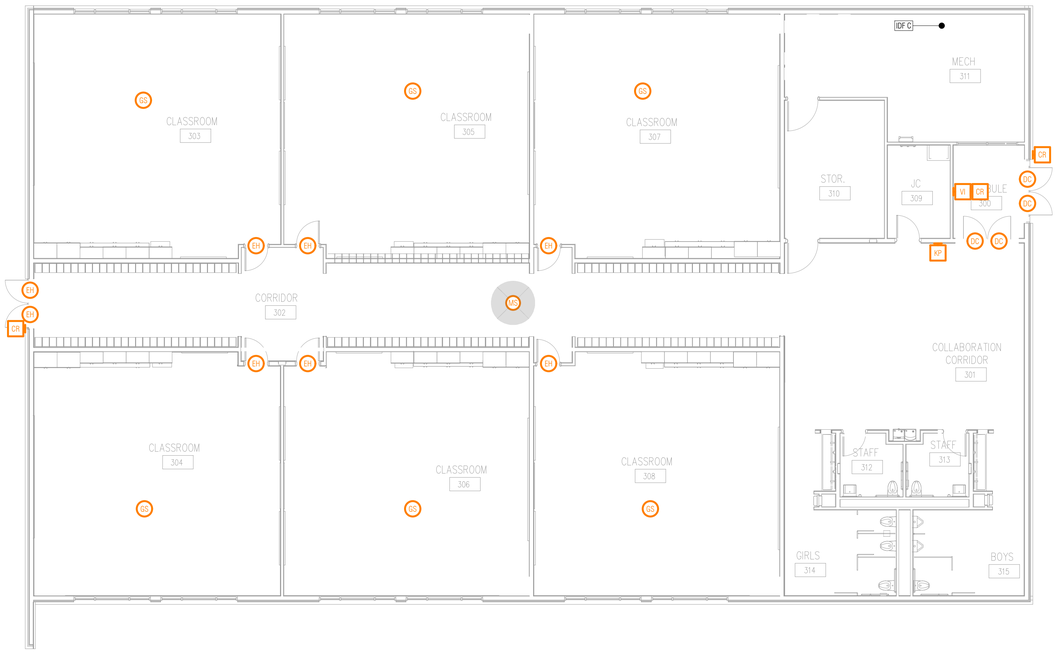
T6.1B



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T6 SHEETS - ACCESS CONTROL & INTRUSION DETECTION SYSTEM

ACCESS CONTROL SYSTEM DEVICES:

- VI — VIDEO INTERCOM
- VIM — VIDEO INTERCOM MASTER STATION
- CR — CARD READER, WALL MOUNTED
- EH — ELECTRIFIED HARDWARE, REFER TO DOOR HARDWARE SCHEDULE FOR DOORS WITH BUILT-IN CARD READERS

INTRUSION DETECTION SYSTEM DEVICES:

- KP — KEYPAD
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5. CONFIGURE SYSTEM TO SEND ALERTS WHEN EXTERIOR DOORS ARE PROPPED OPEN.
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7. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

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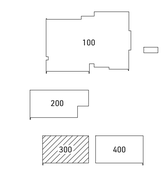

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Bid Package SB-0059

Willow School

Unit 300
Access Control System

T6.1C

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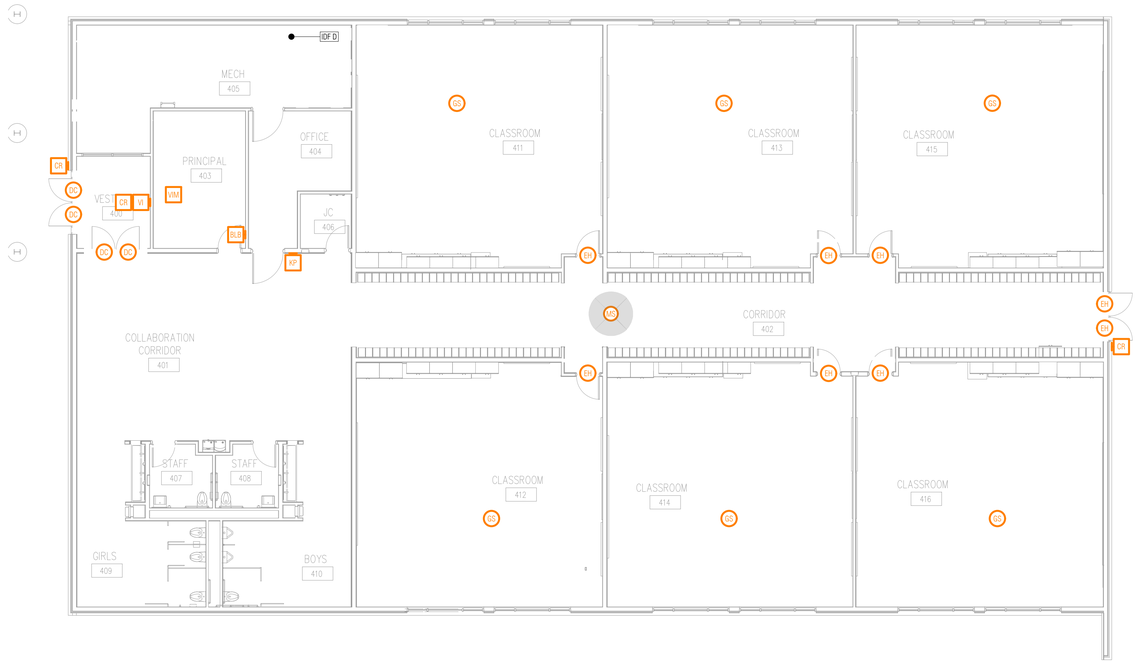

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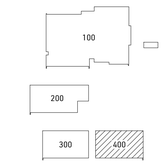

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Bid Package SB-0059

Willow School

Unit 400
Access Control System

T6.1D

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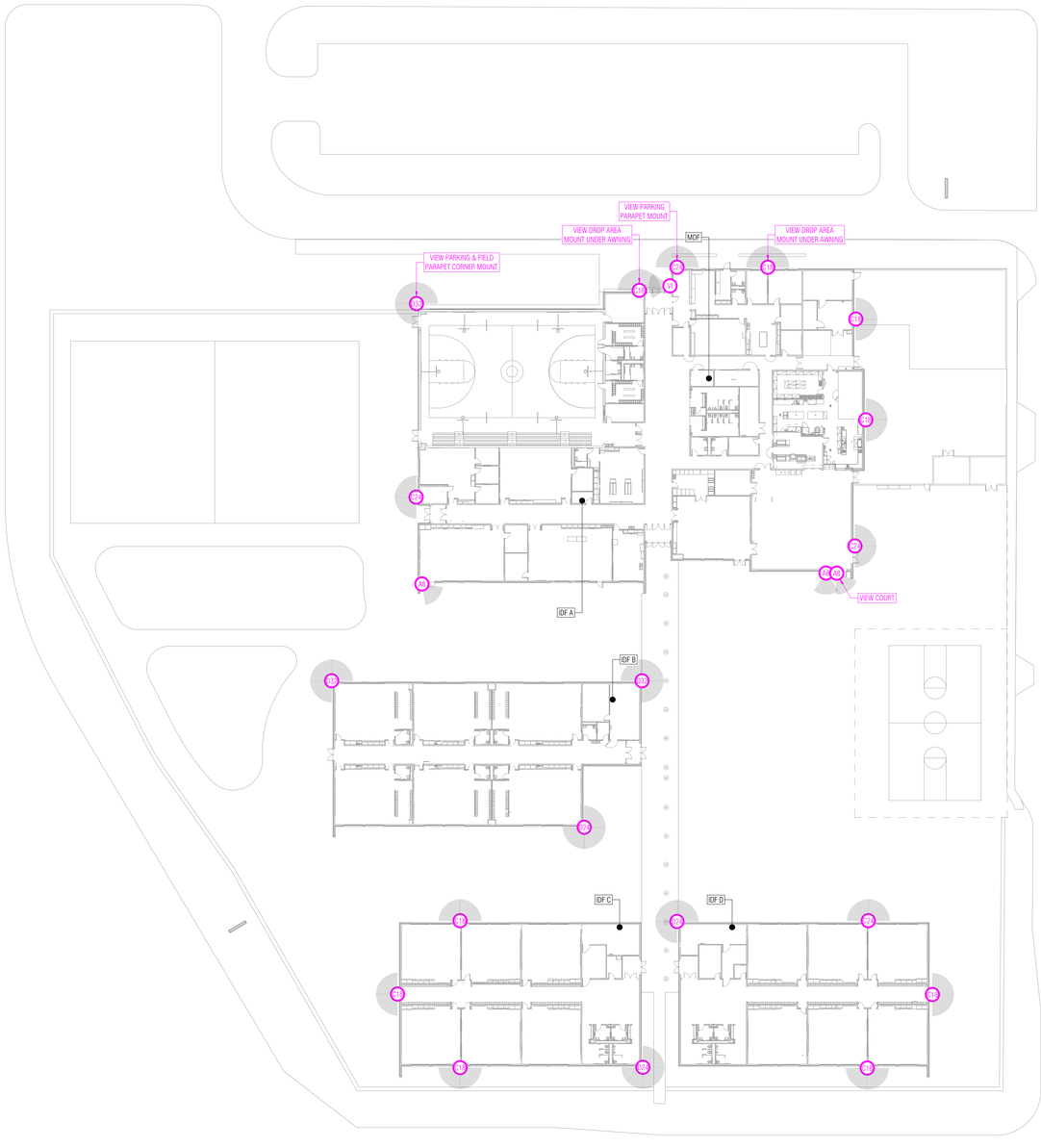

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T7 SHEETS - VIDEO SURVEILLANCE SYSTEM

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CP VIDEO SURVEILLANCE CAMERA; SHADING INDICATES DIRECTION OF VIEW, NOT COVERAGE

A ONE LENS / SENSOR
B TWO LENS / SENSOR
C THREE LENS / SENSOR
D FOUR LENS / SENSOR
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TOTAL MEGAPIXELS FOR CAMERA; DIVIDE BY NUMBER OF SENSORS FOR *MINIMUM* PER SENSOR
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NOTE: EXTERIOR CAMERAS ARE ALSO SHOWN ON UNIT FLOOR PLANS.

N

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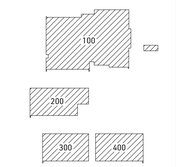

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0' 8' 16' 32' 64'

Bid Package SB-0059

Willow School

Site Plan
Video Surveillance System

T7

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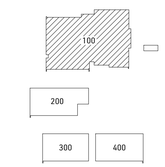

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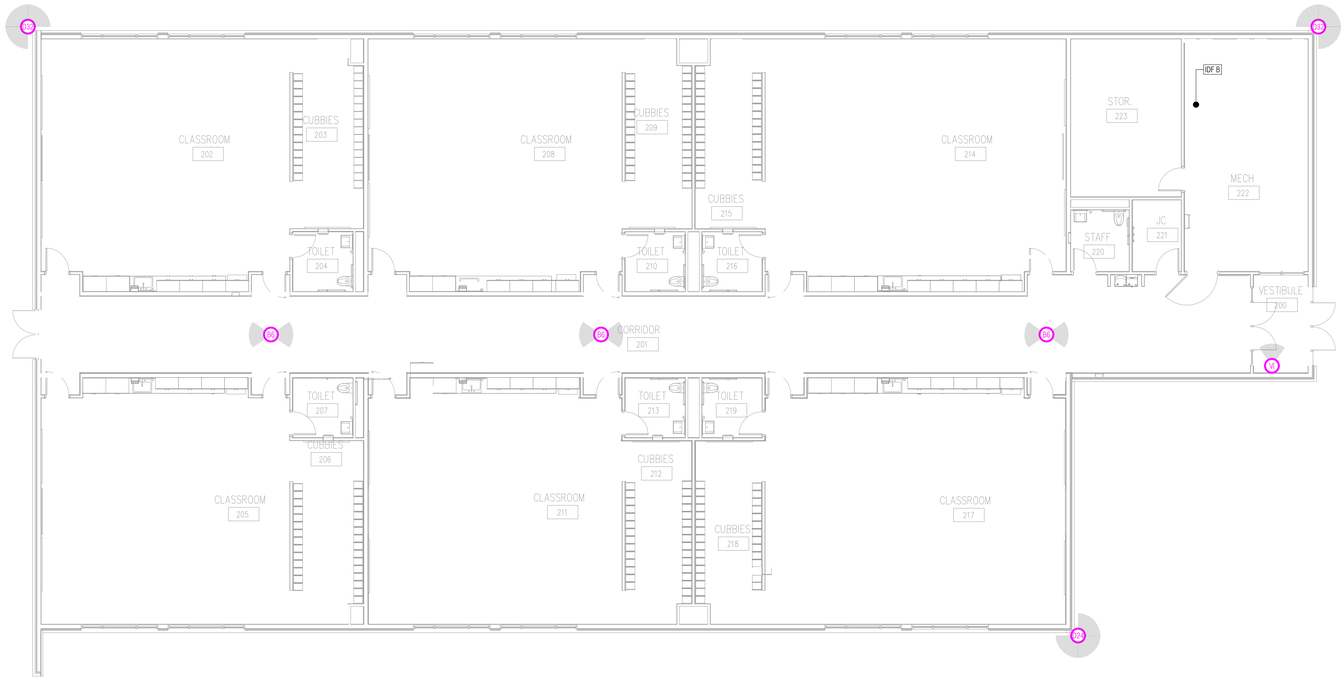
Bid Package SB-0059

Willow School

Unit 100
Video Surveillance System

T7.1A



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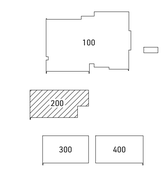

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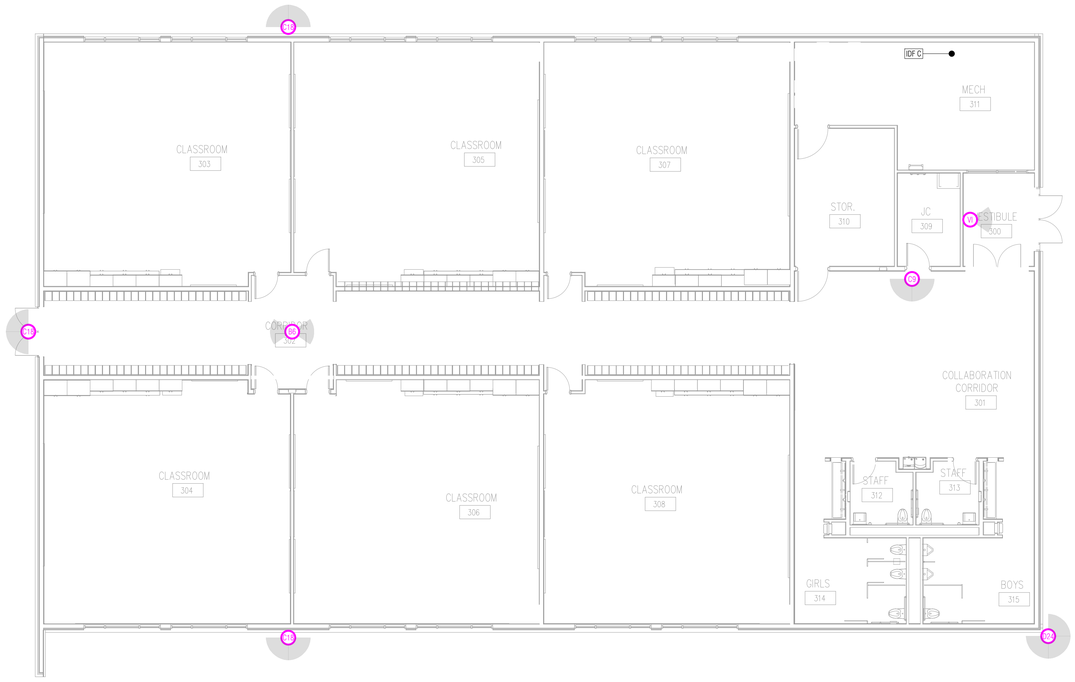
Willow School

Unit 200
Video Surveillance System

N

T7.1B



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6. CONTRACTOR SHALL COORDINATE TELECOMMUNICATION ROOM LAYOUTS WITH ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL COORDINATE ALL EQUIPMENT LOCATIONS AND ROUGH-IN REQUIREMENTS WITH ALL IMPACTED CONTRACTORS PRIOR TO INSTALLATIONS.
8. CONTRACTOR SHALL PROVIDE FACEPLATES AND INSERTS FOR THEIR DEVICES.
9. CONTRACTOR SHALL PROVIDE PROTECTIVE GUARDS ON THEIR DEVICES (CLOCKS, PHONES, ACCESS POINTS, MOTION DETECTORS, ETC.) SUBJECT TO ABUSE IN THE GYMNASIUM.
10. WHEN COLOR / FINISH OPTIONS ARE AVAILABLE, CONTRACTOR SHALL CONFIRM COLOR / FINISH WITH ARCHITECT PRIOR TO ORDERING.

T7 SHEETS - VIDEO SURVEILLANCE SYSTEM

SYMBOL STYLES & ABBREVIATIONS:

CP VIDEO SURVEILLANCE CAMERA; SHADING INDICATES DIRECTION OF VIEW, NOT COVERAGE

A ONE LENS / SENSOR
B TWO LENS / SENSOR
C THREE LENS / SENSOR
D FOUR LENS / SENSOR
F FISHEYE LENS / SENSOR
TOTAL MEGAPIXELS FOR CAMERA; DIVIDE BY NUMBER OF SENSORS FOR *MINIMUM* PER SENSOR
VI VIDEO INTERCOM STATION (BY ACCESS CONTROL CONTRACTOR); INCLUDE FOR VIDEO RECORDING

PROJECT NOTES:

1. CONFIRM ALL MOUNTING LOCATIONS WITH TECHNOLOGY DESIGNER PRIOR TO INSTALLATION.
2. REVIEW AND CONFIRM ALL CAMERA VIEWS AND SETTINGS WITH TECHNOLOGY DESIGNER AND OWNER PRIOR TO ACCEPTANCE; ADJUST AS NECESSARY.
3. ALL EXTERIOR CAMERAS SHALL BE RATED FOR SUCH USE AND BE PROVIDED WITH HOUSING, HEATER, AND BLOWER AS NECESSARY TO OPERATE IN THE INTENDED CLIMATE.
4. ALL EXTERIOR SINGLE-LENS CAMERAS SHALL DOME-STYLE WITH A SUN SHADE.
5. INCLUDE PENDANT ARM MOUNTS FOR EXTERIOR MULTI-LENS CAMERAS DUE TO FIELD CONDITIONS OR TO OBTAIN THE DESIRED VIEW.
6. VIDEO SURVEILLANCE CONTRACTOR TO PROVIDE PATCH CABLES BETWEEN CAMERA AND DATA JACK SUPPLIED BY OTHERS. COORDINATE JACK LOCATIONS WITH STRUCTURED CABLING CONTRACTOR.
7. THE OWNER'S EXISTING SERVERS WILL BE USED FOR THE ADDITIONAL CAMERAS.
8. EQUIPMENT IN UNITS 200, 300, AND 400 MUST USE AN IP CONNECTION TO UNIT 100 HEAD END EQUIPMENT.

Barton Malow

Barton Malow Builders
26500 American Drive
Southfield, MI 48034

248.436.5000
www.bartonmalow.com

Owner:

Lansing School District
Lansing, Michigan

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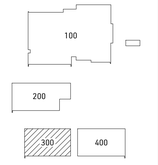
Drawn By: Bill Dawson
Checked By: Paul Twigg

Issued For	Date
BID & CONSTRUCTION	01/26/2024

Key Plan:



Native Page Size: 42" X 30"

Scale: 1/8" = 1'

0' 2' 4' 8' 16'

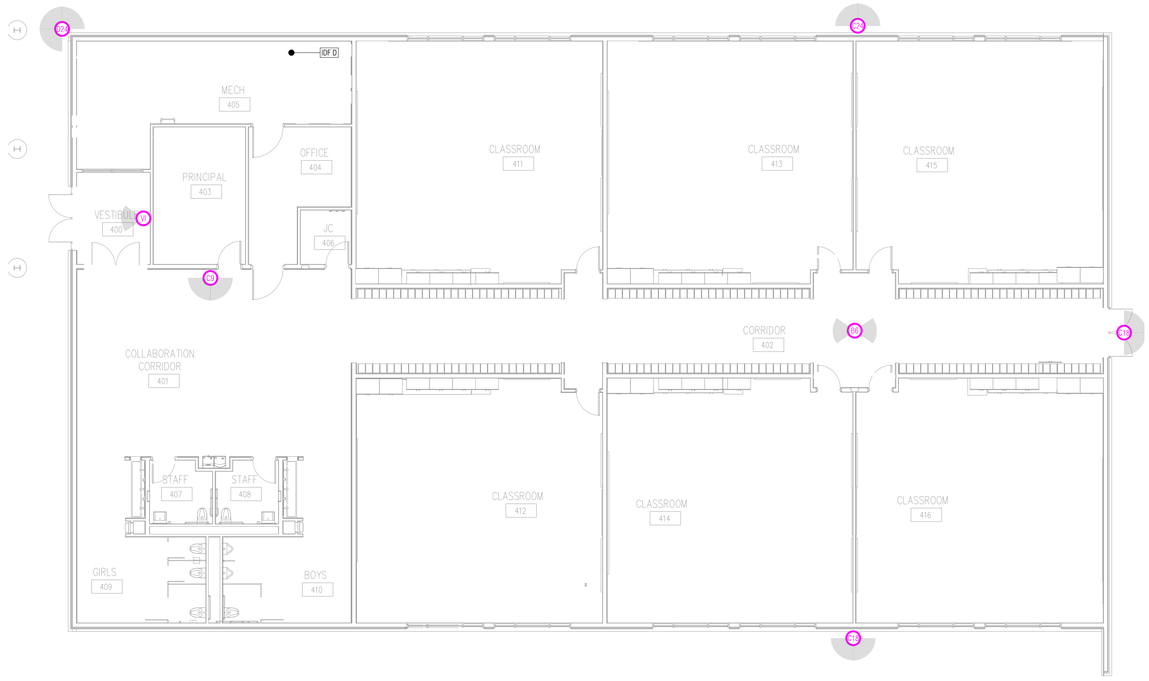
Bid Package SB-0059

Willow School

Unit 300
Video Surveillance System

N

T7.1C



GENERAL TECHNOLOGY NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. CONTRACTORS SHALL PROVIDE ALL INCIDENTAL MATERIALS AND LABOR FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
2. PRIOR TO BEGINNING WORK, CONTRACTORS ARE TO REVIEW BUILDING PLANS, INSTALLATION LOCATIONS, AND SITE CONDITIONS. NOTIFY THE TECHNOLOGY DESIGNER OF ANY CONDITIONS THAT MAY: PREVENT PROPER INSTALLATION AND OPTIMAL PERFORMANCE OF THE SYSTEMS; VOID THE MANUFACTURER'S WARRANTY; OR THAT CONFLICT WITH THE INTENT OF THE PROJECT. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN RESOLVED. THE CONTRACTOR IS RESPONSIBLE FOR ANY ADDITIONAL WORK RELATED TO CORRECTING UNREPORTED CONFLICTS AND ISSUES, AT NO ADDITIONAL COST TO THE OWNER.
3. FIELD VERIFY LOCATIONS, CONDITIONS AND LENGTHS PRIOR TO INSTALLATION.
4. CONTRACTOR IS REQUIRED TO PROVIDE THEIR OWN PENETRATIONS, SLEEVES, AND CORES THROUGH ALL WALLS AND FLOORS. ALL SLEEVES SHALL HAVE NYLON BUSHINGS.
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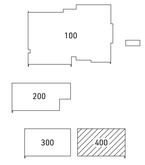

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0' 2' 4' 8' 16'

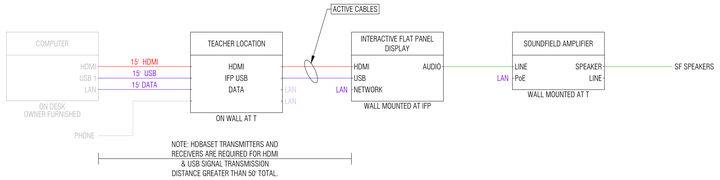
Bid Package SB-0059

Willow School

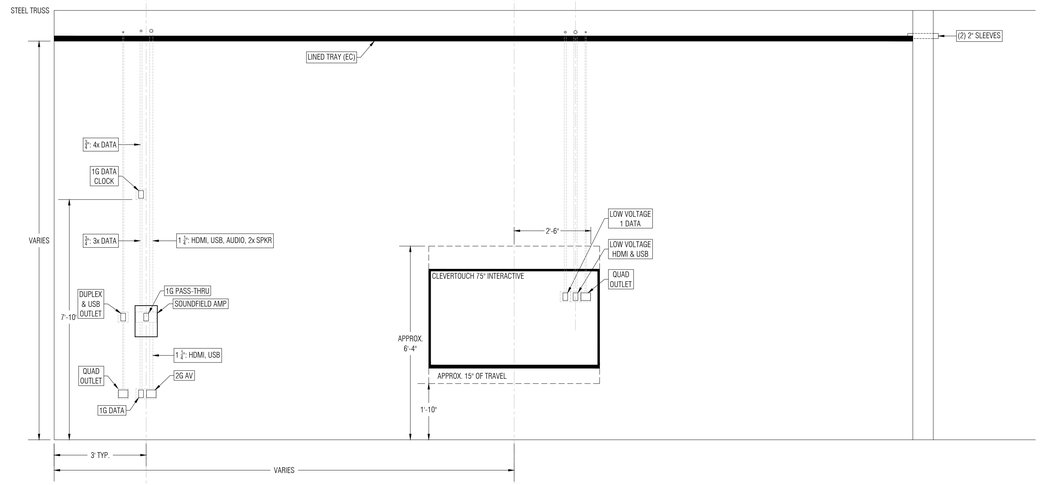
Unit 400
Video Surveillance System

N

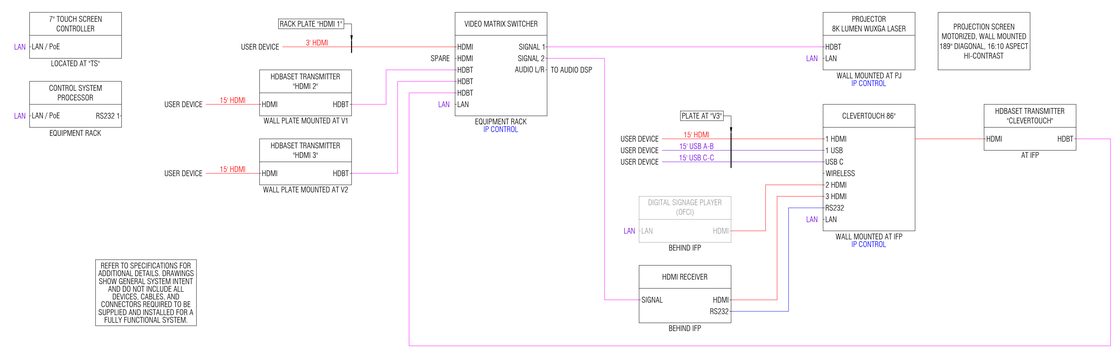
T7.1D

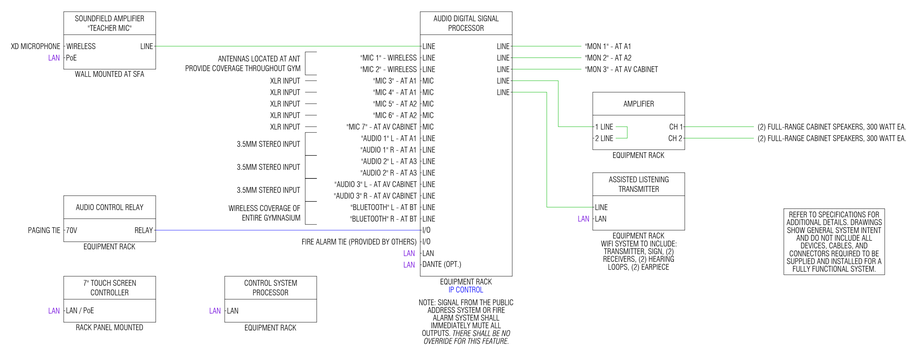


Typical Classroom Audiovisual System Schematic
SCALE: NONE

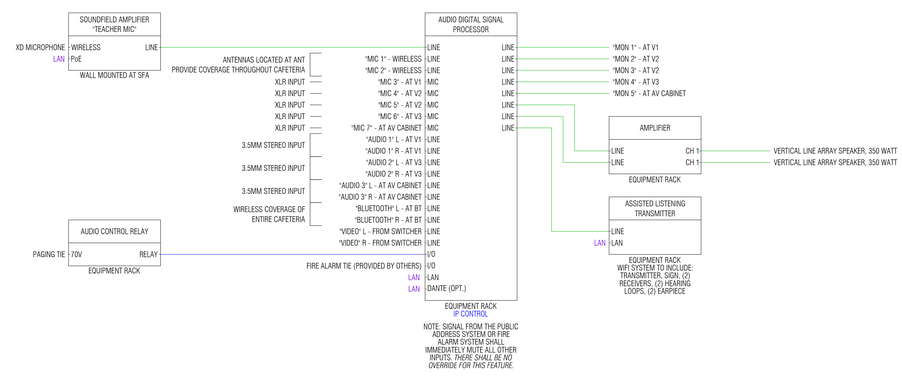


Typical Classroom Interactive Flat Panel & Teacher Station Elevation
SCALE: 1/2" = 1'

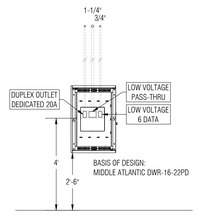




Gymnasium Audio System Schematic
SCALE: NONE



Cafeteria Audiovisual System Schematic
SCALE: NONE



Audio & AV Cabinet Elevation - Typical
SCALE: 3/8" = 1'

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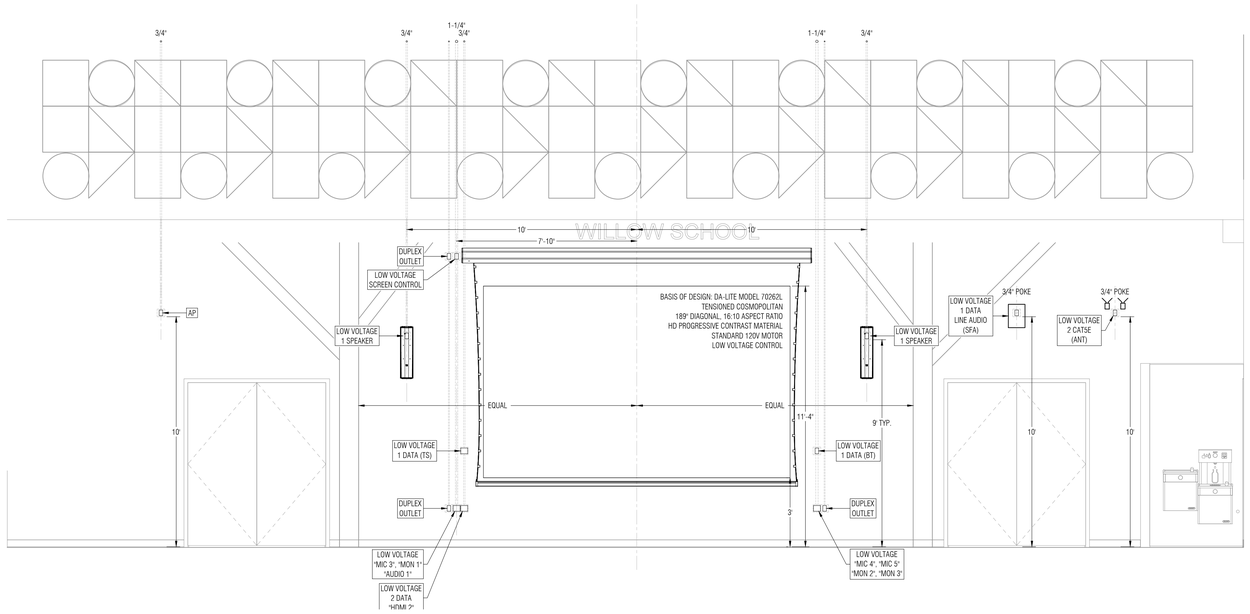
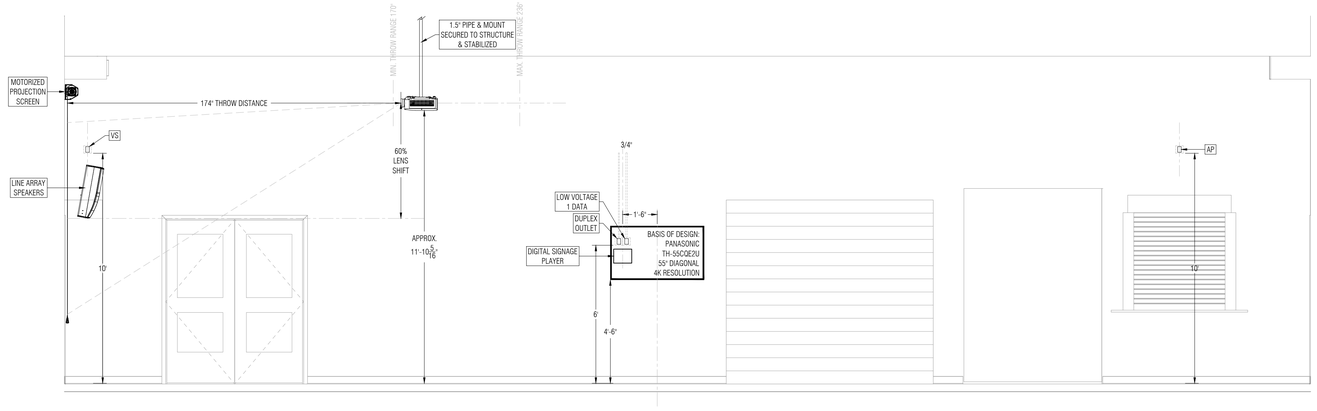
Willow School

Details

T9.1



Cafeteria West Wall Elevation
SCALE: 3/8" = 1'



Cafeteria North Wall Elevation & Projection Section
SCALE: 3/8" = 1'

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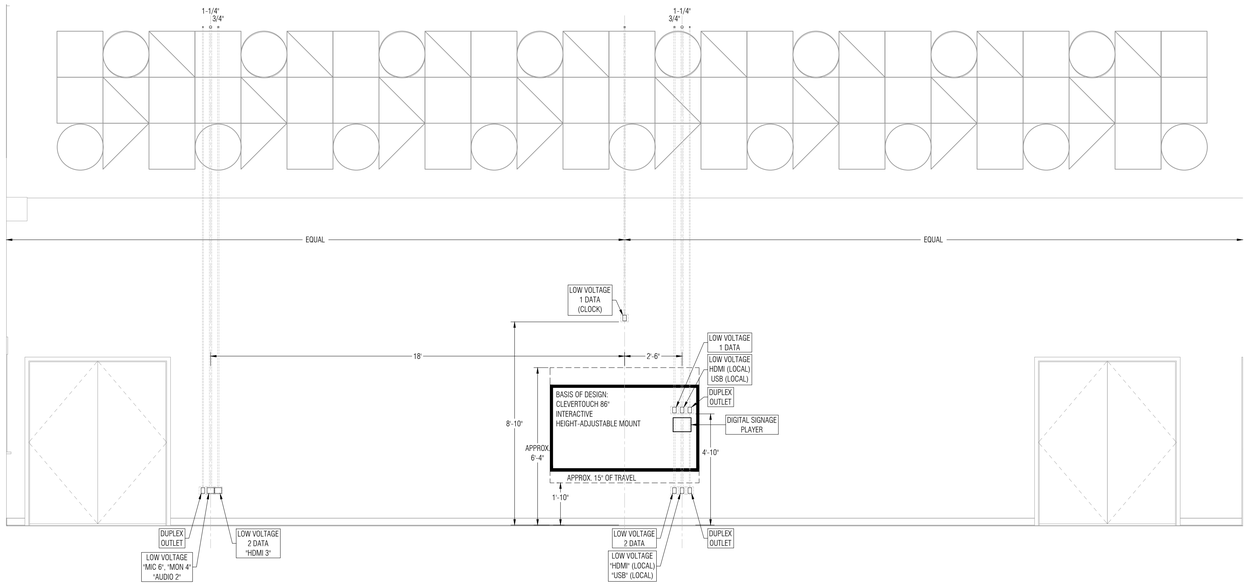
Bid Package SB-0059

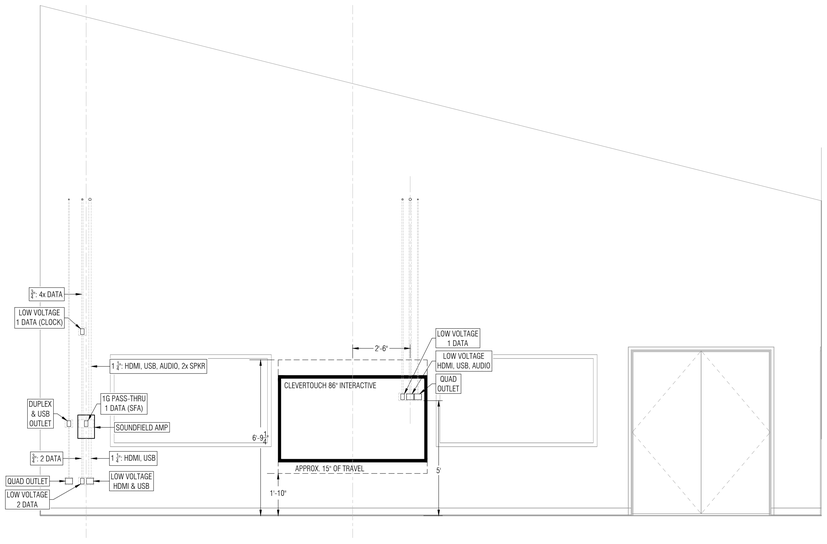
Willow School

Details

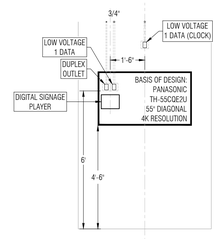
T9.2



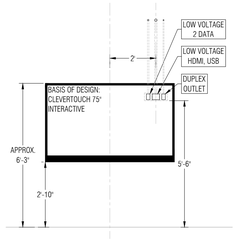
Cafeteria East Wall Elevation
SCALE: 3/8" = 1'



Music Room Display Wall Elevation
SCALE: 3/8" = 1'



Family Room Display Elevation
SCALE: 3/8" = 1'



Conference Room Display Elevation
SCALE: 3/8" = 1'

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www.bartonmalow.com

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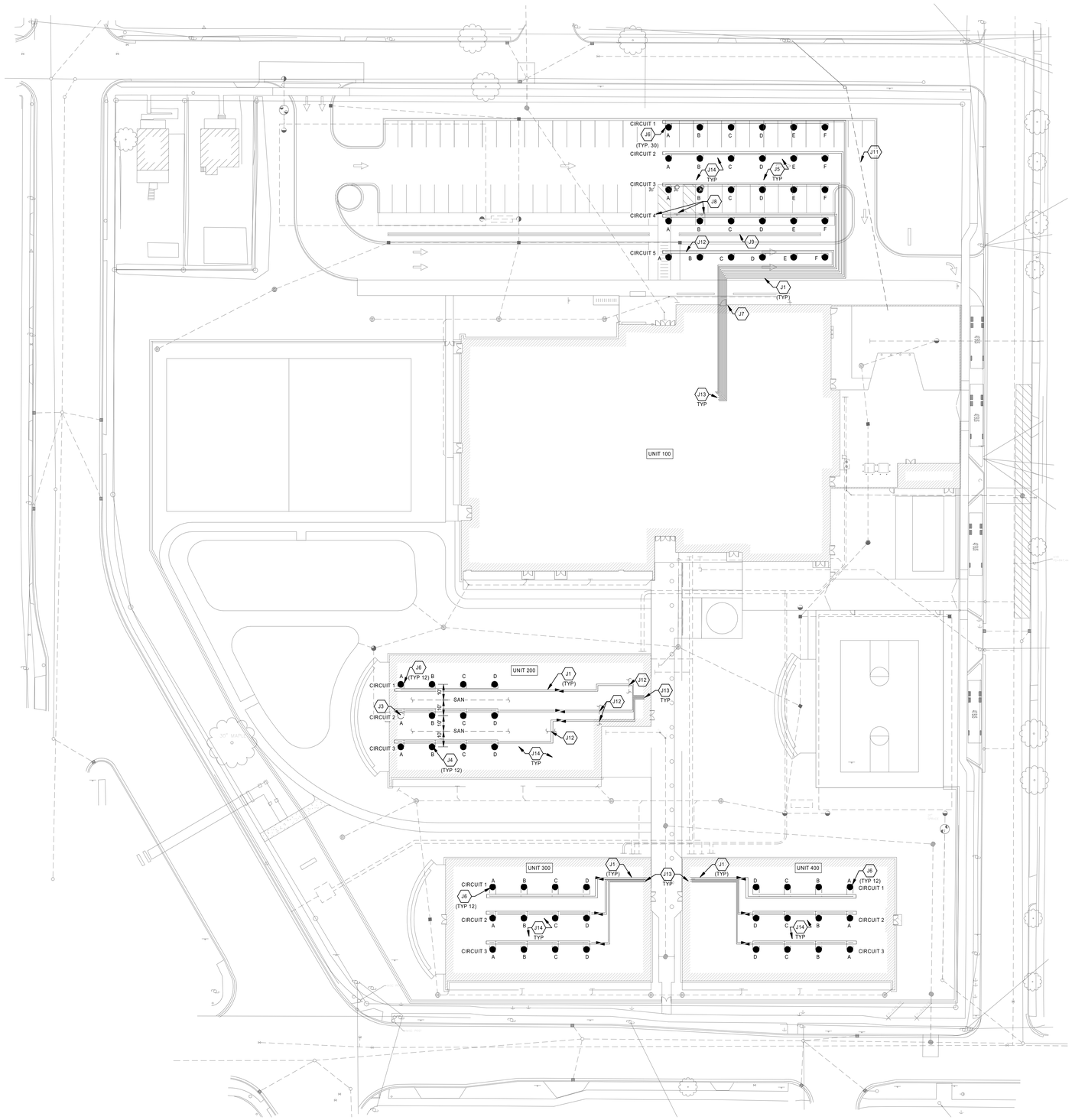
Bid Package SB-0059

Willow School

Details

T9.3



GEOTHERMAL SITE PLAN
SCALE: 1" = 30'-0"

GEOTHERMAL GENERAL NOTES

1. THESE DRAWINGS INDICATE THE GENERAL EXTENT OF THE WORK. PROVIDE A COMPLETE AND WORKING GROUND HEAT EXCHANGER PER SPECIFICATION, IGSHPA STANDARDS, AND PER APPLICABLE CODES INCLUDING ALL NECESSARY, FITTINGS, VALVES, AND ELBOWS WHICH ARE REQUIRED DUE TO SPACE CONSTRAINTS OR OTHER STRUCTURAL CONDITIONS.
2. COORDINATE ALL WORK WITH NEW, EXISTING, AND FUTURE SITE UTILITIES. MARK LOCATION OF ALL UTILITIES PRIOR TO TRENCHING. HAND DIG TRENCHES AROUND EXISTING UTILITY MAINS.
3. PROTECT THE UTILITIES SHOWN ON THE DRAWINGS OR THE LOCATIONS OF WHICH ARE KNOWN PRIOR TO EXCAVATION, FROM DAMAGE DURING EXCAVATION AND BACKFILLING OF TRENCHES AND, IF DAMAGED, REPAIR THEM AT NO EXPENSE TO THE OWNER.
4. DO NOT ALLOW WATER TO ACCUMULATE IN EXCAVATIONS. PREVENT SURFACE WATER AND SUBSURFACE OR GROUND WATER FROM FLOWING INTO EXCAVATIONS. PROVIDE AND MAINTAIN PUMPS, WELL POINTS, SUMPS, SUCTION AND DISCHARGE LINES, AND OTHER DEWATERING SYSTEM COMPONENTS NECESSARY TO CONVEY WATER AWAY FROM EXCAVATIONS.
5. PIPE SHALL BE INSTALLED IN ACCORDANCE WITH RECOMMENDATIONS OF ASHRAE AND IGSHPA. PIPE JOINTS SHALL BE HEAT FUSION TYPE AND SHALL BE MADE AS RECOMMENDED BY THE PIPE MANUFACTURER.
6. OPEN ENDS OF ALL PIPE SHALL BE SEALED TO PREVENT ENTRY OF CONTAMINANTS UNTIL FINAL CONNECTIONS ARE MADE. TAPE IS NOT APPROVED
7. VERTICAL LOOP PIPING SHALL BE FILLED WITH WATER AND PRESSURE TESTED PRIOR TO INSERTION INTO THE BOREHOLE, AFTER INSERTION IN THE BORE, AND TESTED AGAIN AFTER MANIFOLDING. AFTER CONNECTION TO THE HEADER PIPING AND PRIOR TO BACKFILLING, EACH LATERAL SHALL BE FILLED WITH WATER AND PRESSURE TESTED. RESULTS OF ALL TESTS SHALL BE RECORDED AND SUPPLIED TO THE CM UPON COMPLETION OF THE PROJECT.
8. COORDINATE FOUNDATION, FLOOR, AND WALL PENETRATIONS WITH ARCHITECTURAL TRADES.
9. DO NOT BACKFILL TRENCHES UNTIL ALL REQUIRED INSPECTIONS ARE MADE AND TESTS ARE PERFORMED. BACKFILL HORIZONTAL TRENCHES PER DETAILS AND SPECIFICATIONS.
10. GEOTHERMAL CONTRACTOR TO FOLLOW REQUIREMENTS OF MICHIGAN D.E.Q. BEST PRACTICES FOR GEOTHERMAL CLOSED LOOP SYSTEMS.
11 GROUTING COMPOUND AS ALL GROUTING MATERIALS SHALL BE CERTIFIED AND LISTED BY THE NATIONAL SANITATION FOUNDATION NSF STANDARD 60
12 ALL FLUSHING AND PURGING SHALL BE WITNESSED BY COMMISSIONING AGENT (CXA).
13 AFTER FLUSHING, PURGING, AND PRESSURE TESTS ARE COMPLETE, GEOTHERMAL CONTRACTOR SHALL LEAVE GEOTHERMAL PIPING FILLED WITH MUNICIPAL CITY WATER.

GEOTHERMAL SITE GENERAL NOTES

1 GEOTHERMAL CONTRACTOR SHALL COORDINATE WITH CM AND OWNER ON DRILLING SPOILS/FLUIDS DISPOSAL.
2 CONTRACTOR TO PROVIDE WATER AS NEEDED THROUGHOUT INSTALLATION OF GEOTHERMAL GROUND HEAT EXCHANGER. USE OF LOCAL FIRE HYDRANT(S) IS PERMITTED BY OBTAINING A USAGE PERMIT FROM AHJ; A CERTIFIED BACK FLOW PREVENTION DEVICE IS REQUIRED.
3 DRILL LOG SHALL BE PROVIDED FOR EVERY BOREHOLE DRILLED ON SITE INDIVIDUALLY AS EACH BORE IS COMPLETED. CONTRACTOR TO UTILIZE DRILL LOG TEMPLATE FORM INCLUDED IN GEOTHERMAL SPECIFICATIONS AND PROVIDE CM/ENGINEER FIELD REPRESENTATIVE COMPLETE DRILL LOG FOLLOWING THE DRILLING/LOOPING/GROUTING OF EACH BOREHOLE.
4 CONTRACTOR TO UTILIZE GPS TRACKING TO RECORD LOCATIONS OF ALL BOREHOLES DURING INSTALLATION OF GROUND HEAT EXCHANGER. AS BUILTS SHALL CONTAIN GPS COORDINATES FOR EACH BOREHOLE. PROVIDE GPS COORDINATE FOR EVERY CHANGE IN DIRECTION OF MAIN PIPING.
5 GEOTHERMAL CONTRACTOR TO MAINTAIN NO LESS THAN 10'-0" SEPARATION BETWEEN VERTICAL BORE HOLE AND STORM AND SANITARY UTILITY PIPING.

GEOTHERMAL KEYNOTES

J1 GEOTHERMAL SUPPLY/RETURN PIPING TO/FROM GEOTHERMAL MANIFOLD LOCATED IN MECHANICAL ROOM.
J2 GEOTHERMAL MANIFOLDS CONSISTING OF SUPPLY/RETURN HEADER PIPING. REFER TO PIPING DETAIL ON SHEET GHX2.1.
J3 PREVIOUSLY INSTALLED TEST BORE LOCATION TO BE UTILIZED. CONTRACTOR TO FIELD VERIFY EXACT LOCATION. CONNECT EXISTING 1 1/4" HDPE SUPPLY/RETURN BORE HOLE PIPING TO NEW HORIZONTAL HEADER PIPING.
J4 COORDINATE GEOTHERMAL BORE WITH STORM AND SANITARY PIPING. MAINTAIN MIN 10'-0" SEPARATION BETWEEN VERTICAL BORE AND UTILITY PIPING.
J5 COORDINATE GEOTHERMAL BORE WITH LIGHT POLE LOCATION. CM TO COORDINATE WITH INSTALLING CONTRACTOR TO ENSURE ANY REQUIRED FOUNDATION FOR LIGHT POLE IS HAND DUG. ENSURE THERE IS NO DAMAGE TO ANY GEOTHERMAL PIPING DURING LIGHT POLE INSTALLATION.
J6 VERTICAL GEOTHERMAL BOREHOLE. REFER TO SUMMARY TABLE FOR ADDITIONAL INFORMATION. SIZE OF BOREHOLE IS DIAGRAMMATIC IN SCALE. TYPICAL BORE HOLE IS 6"Ø.
J7 COORDINATE GEOTHERMAL PIPING WITH FOUNDATION AND ROUTE THROUGH FOUNDATION. COORDINATE AND REFER TO STRUCTURAL. PROVIDE SLEEVES FOR PIPING.
J8 COORDINATE GEOTHERMAL BORE WITH HANDICAP SIGN FOOTING. CM TO COORDINATE WITH INSTALLING CONTRACTOR TO ENSURE ANY REQUIRED FOUNDATION FOR SIGN IS HAND DUG. ENSURE THERE IS NO DAMAGE TO ANY GEOTHERMAL PIPING DURING SIGN INSTALLATION.
J9 COORDINATE GEOTHERMAL BORE WITH DECORATIVE FENCING FOOTING. CM TO COORDINATE WITH INSTALLING CONTRACTOR TO ENSURE ANY REQUIRED FOUNDATION FOR DECORATIVE FENCING IS HAND DUG. ENSURE THERE IS NO DAMAGE TO ANY GEOTHERMAL PIPING DURING FENCING INSTALLATION.
J11 APPROXIMATE LOCATION OF UNDERGROUND POWER. COORDINATE EXACT LOCATION IN FIELD.
J12 WHERE GEOTHERMAL PIPING CROSSES STORM/SANITARY PIPING INSULATE STORM/SANITARY PIPING AND PROVIDE NOT LESS THAN 3FT OF SEPARATION.
J13 GEOTHERMAL CIRCUIT PIPING UP TO MANIFOLD LOCATED IN MECHANICAL ROOM.
J14 REFER TO DETAIL ON GHX5.0 FOR CIRCUIT PIPE SIZING.

KINGSCOTT
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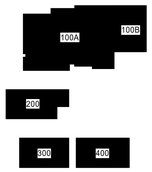
Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024



KEY PLAN

ISD NO. SB-0059
JOB NO. 2616.01A

N

SHEET TITLE
GEOTHERMAL SITE PLAN

SHEET NO.
GHX1.0

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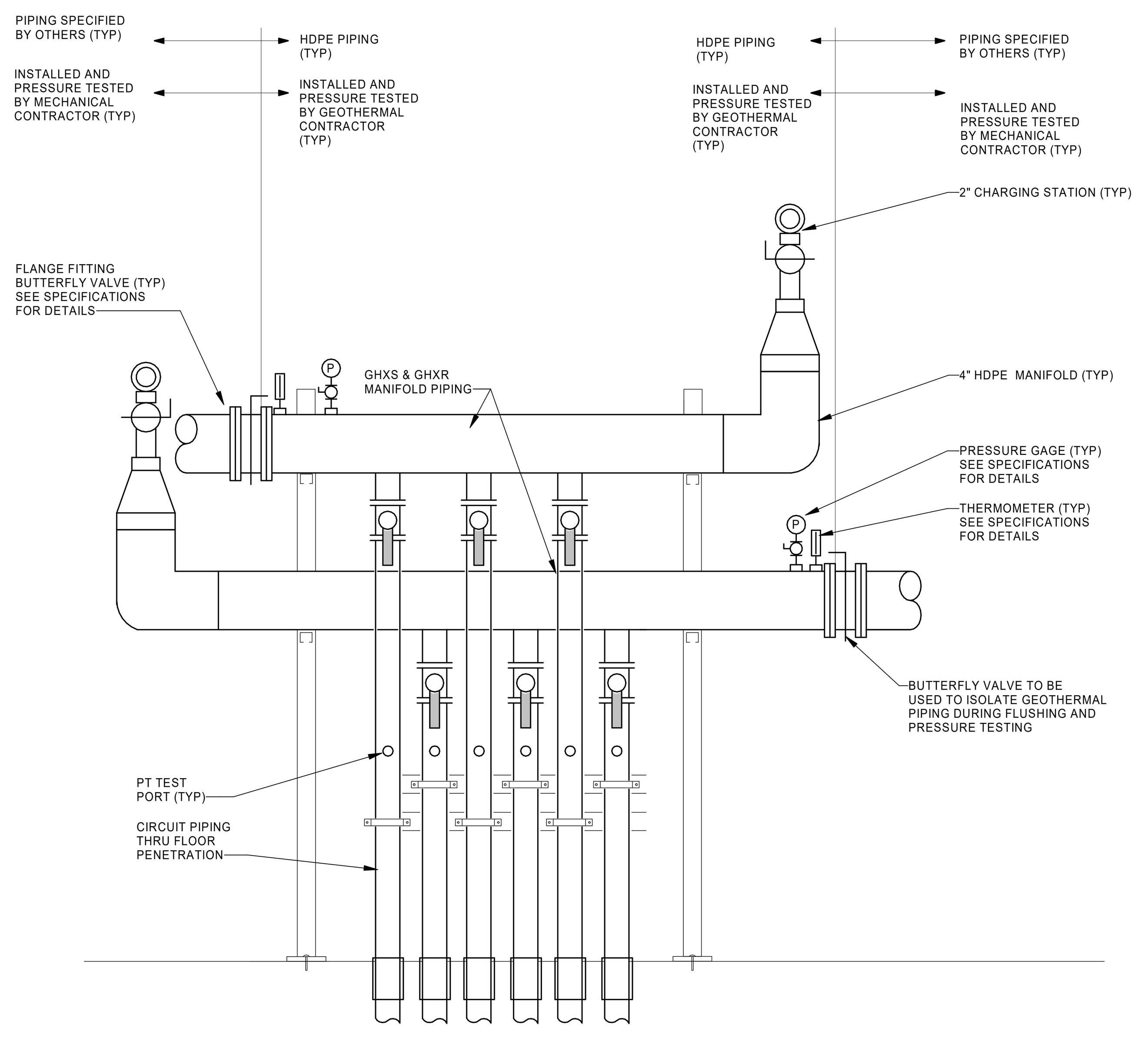
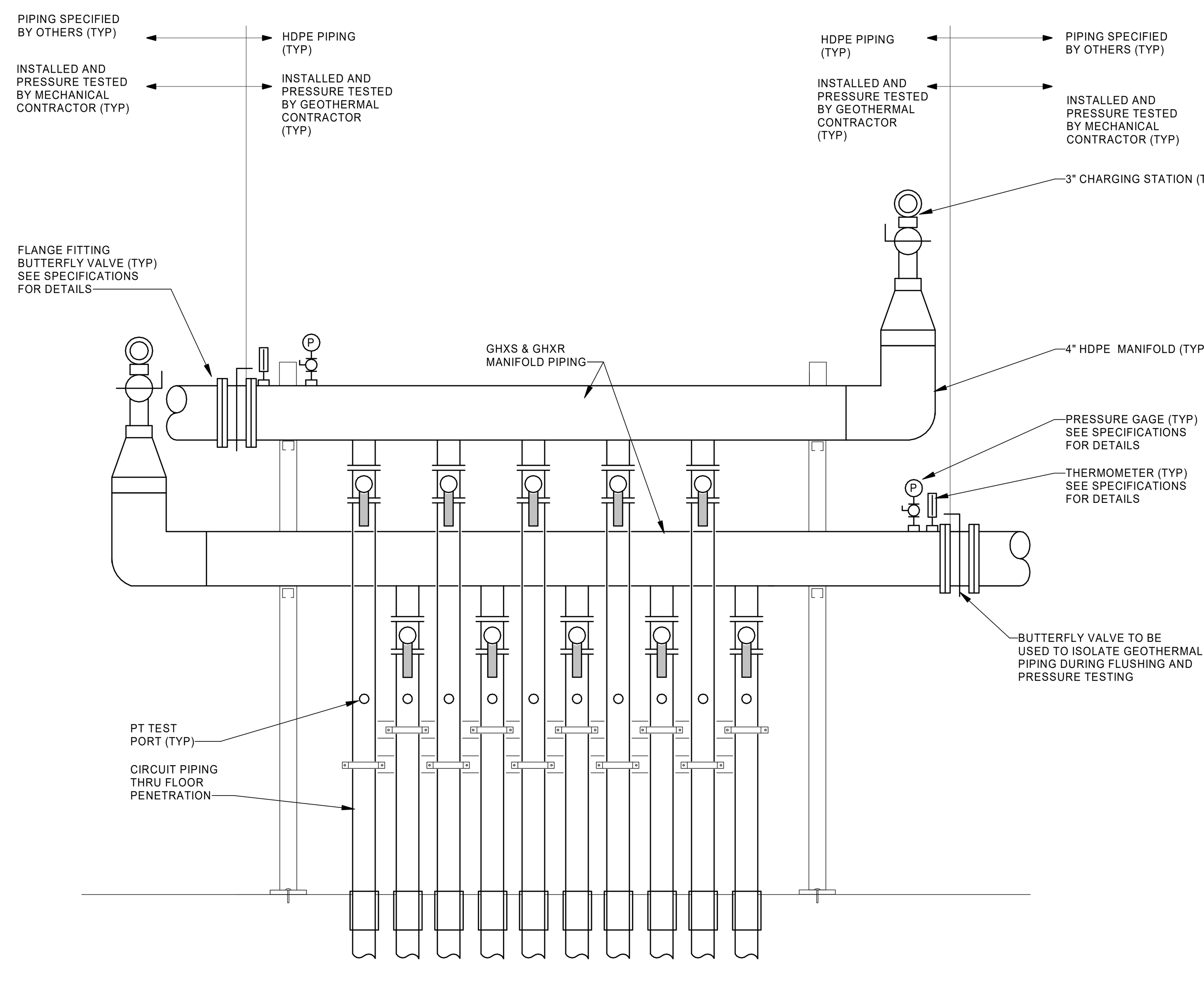
PIPING SYSTEM PRESSURE TEST TABLE

SYSTEM	MEDIA	PRESSURE	PREMISSIBLE PRESSURE DROP
GEOTHERMAL PIPING ABOVE GROUND	WATER	100 PSIG	PRESSURE TO HOLD OVER 100 PSIG FOR 1 HOUR
GEOTHERMAL PIPING BELOW GROUND	WATER	100 PSIG	PRESSURE TO HOLD OVER 100 PSIG FOR 1 HOUR

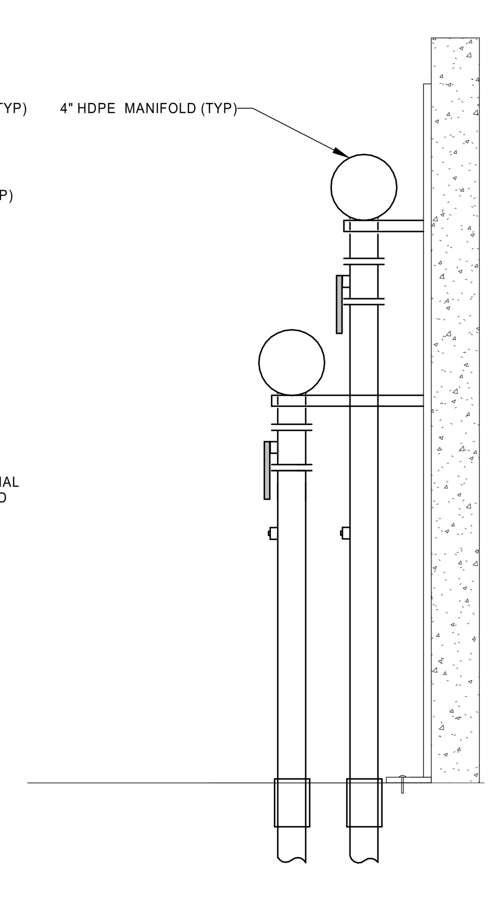
NOTES:
1. PRESSURE TEST SHALL MEET REQUIREMENTS OF TABLE OR 1 1/2 TIMES OPERATING PRESSURE, WHICHEVER IS GREATER.
2. GEOTHERMAL PIPING SHALL BE INDEPENDENTYL TESTED FROM THE REST OF THE PIPING SYSTEM. ISOLATE GEOTHERMAL PIPING DURING PRESSURE TEST. REFER TO GEOTHERMAL MANIFOLD DETAIL ELEVATION ON GHX5.0.



TYPICAL GEOTHERMAL MANIFOLD ELEVATION - UNIT 200, 300, 400

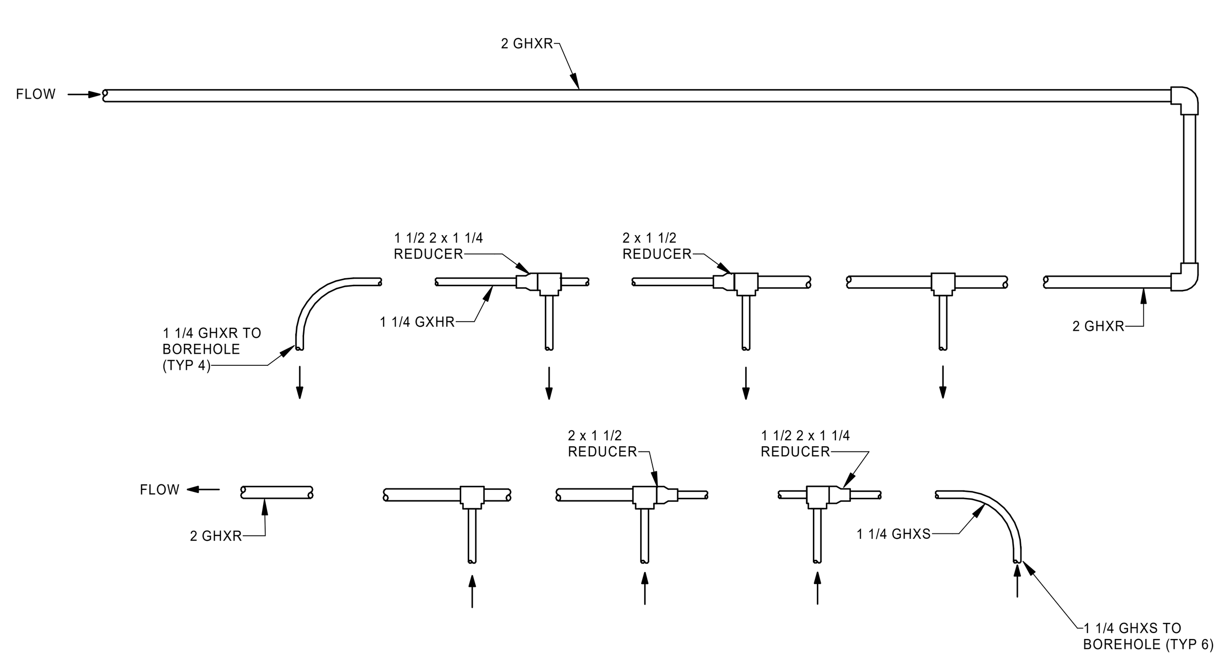


TYPICAL GEOTHERMAL MANIFOLD ELEVATION - UNIT 100

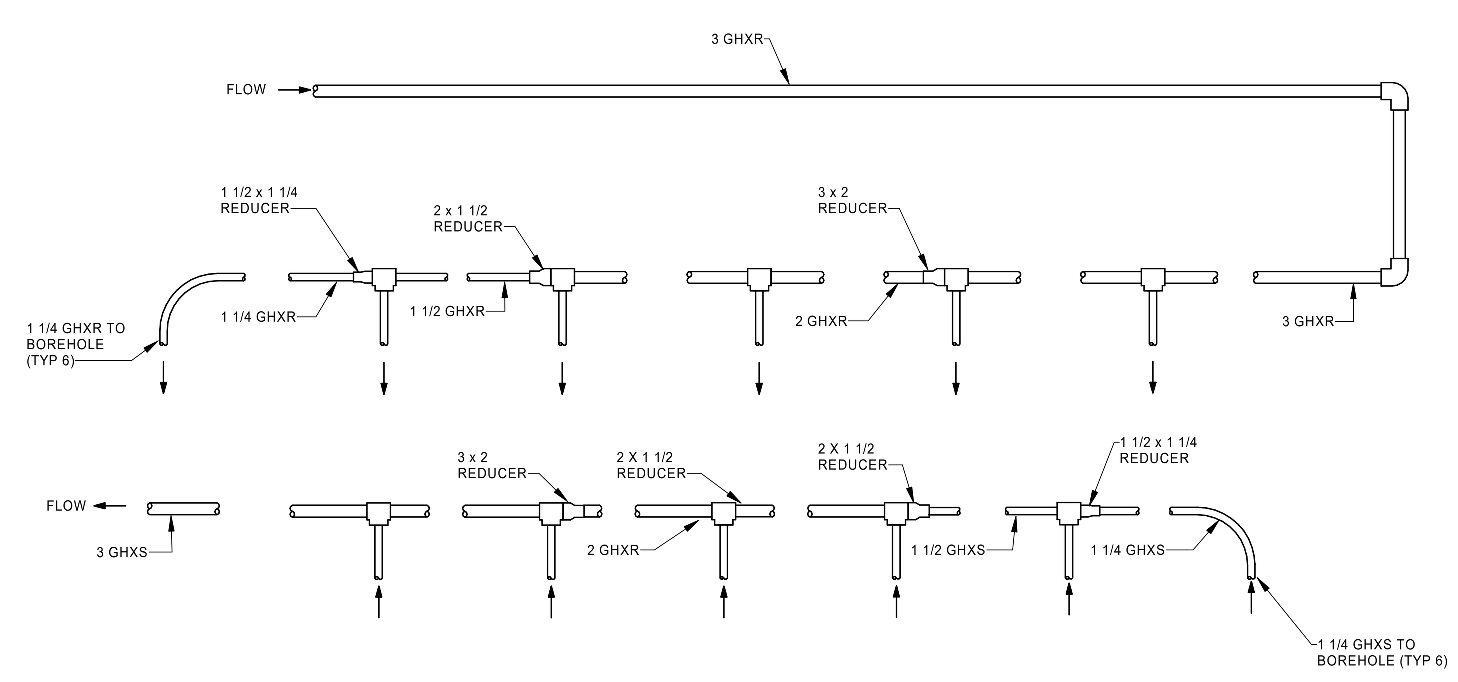


SECTION

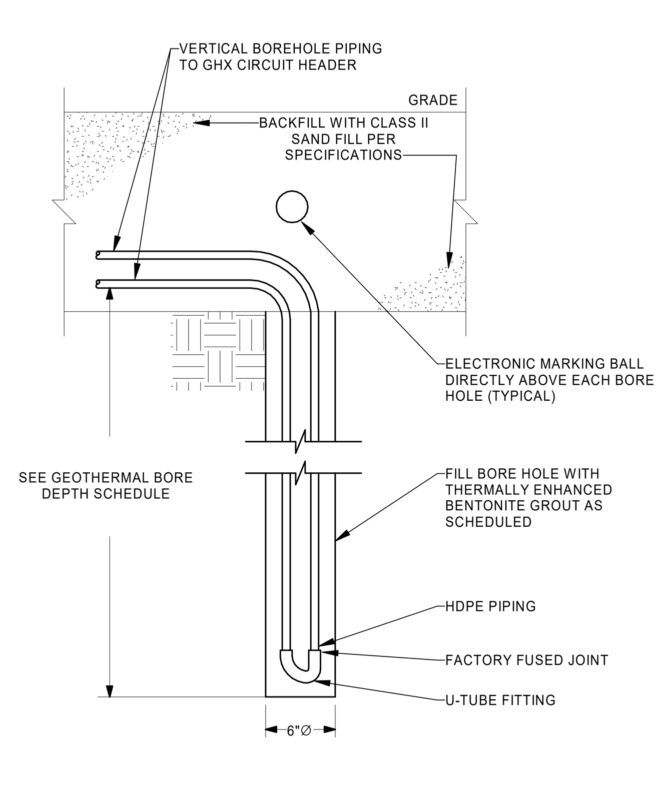
GEOTHERMAL MANIFOLD DETAIL
NO SCALE



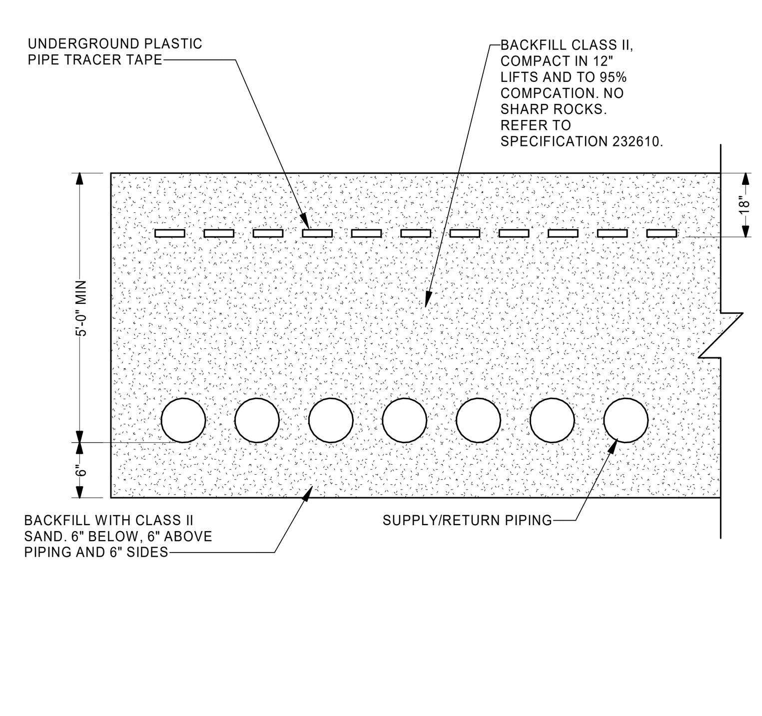
GHX CIRCUIT HEADER DETAIL - UNITS 200, 300, 400
NO SCALE



GHX CIRCUIT HEADER DETAIL - UNIT 100
NO SCALE



GHX BORE FITTING DETAIL
NO SCALE



PARTIAL GEOTHERMAL TRENCH DETAIL
NO SCALE

GROUND HEAT EXCHANGER SUMMARY INFORMATION - UNIT 100

HEAT EXCHANGER INFORMATION	
CONFIGURATION	VERTICAL CLOSED LOOP
BOREHOLE QUANTITY	30
BOREHOLE PIPE SIZE	1 1/4 INCH
BOREHOLE ACTIVE DEPTH	500' (TYPICAL FOR 30)
BOREHOLE TOTAL DEPTH	505' (TYPICAL FOR 30)
BOREHOLE SEPARATION	20 FT ON CENTER
NUMBER OF CIRCUITS	5
FUTURE CIRCUIT SUPPLY AND RETURNS	NONE
* SOIL THERMAL CONDUCTIVITY	2.0 BTU/H-FT-°F
*SOIL DIFFUSIVITY	1.4 FT^2/DAY
*UNDISTURBED GROUND TEMEPRATURE	53.7°F
GHX PRESSURE DROP	62 FT
SYSTEM FLUID INFORMATION	
TOTAL FLOW	285 GPM
FLUID	23% PROPYLENE GLYCOL
**GHX VOLUME	-
MINIMUM HEAT PUMP INLET FLUID TEMP	32°F
MAXIMUM HEAT PUMP INLET FLUID TEMP	90°F
GROUT INFORMATION	
GROUT TYPE	THERMALLY ENHANCED BENTONITE
NMINIMUM THERMAL CONDUCTIVITY	1.2 BTU/H-FT-°F
FLUSH & PURGE INFORMATION	
MINIMUM FLUID VELOCITY	2.0 FT/SEC
MINIMUM PURGE FLOW (PER CIRCUIT)	~57 GPM
PURGE PRESSURE DROP (PER CIRCUIT)	62 FT
GHX CAPACITY INFORMATION	
PEAK HEATING	746 MBH
PEAK COOLING	1137 MBH
HEATING EFLH	986 HOURS
COOLING EFLH	536 HOURS

* GIVEN VALUES ARE BASED ON FTC TESTS COMPLETED SEPTEMBER 1-3, 2023
** GHX TOTAL VOLUME TO BE CALCULATED BY GEOTHERMAL CONTRACTOR BASED ON AS-BUILT CONFIGURATION.

GROUND HEAT EXCHANGER SUMMARY INFORMATION - UNIT 200

HEAT EXCHANGER INFORMATION	
CONFIGURATION	VERTICAL CLOSED LOOP
BOREHOLE QUANTITY	12
BOREHOLE PIPE SIZE	1 1/4 INCH
BOREHOLE ACTIVE DEPTH	425' (TYPICAL FOR 12)
BOREHOLE TOTAL DEPTH	430' (TYPICAL FOR 12)
BOREHOLE SEPARATION	20 FT ON CENTER
NUMBER OF CIRCUITS	3
FUTURE CIRCUIT SUPPLY AND RETURNS	NONE
* SOIL THERMAL CONDUCTIVITY	2.0 BTU/H-FT-°F
*SOIL DIFFUSIVITY	1.4 FT^2/DAY
*UNDISTURBED GROUND TEMEPRATURE	53.7°F
GHX PRESSURE DROP	42 FT
SYSTEM FLUID INFORMATION	
TOTAL FLOW	90 GPM
FLUID	23% PROPYLENE GLYCOL
**GHX VOLUME	-
MINIMUM HEAT PUMP INLET FLUID TEMP	32°F
MAXIMUM HEAT PUMP INLET FLUID TEMP	90°F
GROUT INFORMATION	
GROUT TYPE	THERMALLY ENHANCED BENTONITE
NMINIMUM THERMAL CONDUCTIVITY	1.2 BTU/H-FT-°F
FLUSH & PURGE INFORMATION	
MINIMUM FLUID VELOCITY	2.0 FT/SEC
MINIMUM PURGE FLOW (PER CIRCUIT)	40 GPM
PURGE PRESSURE DROP (PER CIRCUIT)	80 FT
GHX CAPACITY INFORMATION	
PEAK HEATING	344 MBH
PEAK COOLING	238 MBH
HEATING EFLH	999 HOURS
COOLING EFLH	328 HOURS

* GIVEN VALUES ARE BASED ON FTC TESTS COMPLETED SEPTEMBER 1-3, 2023
** GHX TOTAL VOLUME TO BE CALCULATED BY GEOTHERMAL CONTRACTOR BASED ON AS-BUILT CONFIGURATION.

GROUND HEAT EXCHANGER SUMMARY INFORMATION - UNIT 300

HEAT EXCHANGER INFORMATION	
CONFIGURATION	VERTICAL CLOSED LOOP
BOREHOLE QUANTITY	12
BOREHOLE PIPE SIZE	1 1/4 INCH
BOREHOLE ACTIVE DEPTH	425' (TYPICAL FOR 12)
BOREHOLE TOTAL DEPTH	430' (TYPICAL FOR 12)
BOREHOLE SEPARATION	20 FT ON CENTER
NUMBER OF CIRCUITS	3
FUTURE CIRCUIT SUPPLY AND RETURNS	NONE
* SOIL THERMAL CONDUCTIVITY	2.0 BTU/H-FT-°F
*SOIL DIFFUSIVITY	1.4 FT^2/DAY
*UNDISTURBED GROUND TEMEPRATURE	53.7°F
GHX PRESSURE DROP	27 FT
SYSTEM FLUID INFORMATION	
TOTAL FLOW	85 GPM
FLUID	23% PROPYLENE GLYCOL
**GHX VOLUME	-
MINIMUM HEAT PUMP INLET FLUID TEMP	32°F
MAXIMUM HEAT PUMP INLET FLUID TEMP	90°F
GROUT INFORMATION	
GROUT TYPE	THERMALLY ENHANCED BENTONITE
NMINIMUM THERMAL CONDUCTIVITY	1.2 BTU/H-FT-°F
FLUSH & PURGE INFORMATION	
MINIMUM FLUID VELOCITY	2.0 FT/SEC
MINIMUM PURGE FLOW (PER CIRCUIT)	40 GPM
PURGE PRESSURE DROP (PER CIRCUIT)	61 FT
GHX CAPACITY INFORMATION	
PEAK HEATING	329 MBH
PEAK COOLING	220 MBH
HEATING EFLH	948 HOURS
COOLING EFLH	389 HOURS

* GIVEN VALUES ARE BASED ON FTC TESTS COMPLETED SEPTEMBER 1-3, 2023
** GHX TOTAL VOLUME TO BE CALCULATED BY GEOTHERMAL CONTRACTOR BASED ON AS-BUILT CONFIGURATION.

GROUND HEAT EXCHANGER SUMMARY INFORMATION - UNIT 400

HEAT EXCHANGER INFORMATION	
CONFIGURATION	VERTICAL CLOSED LOOP
BOREHOLE QUANTITY	12
BOREHOLE PIPE SIZE	1 1/4 INCH
BOREHOLE ACTIVE DEPTH	425' (TYPICAL FOR 12)
BOREHOLE TOTAL DEPTH	430' (TYPICAL FOR 12)
BOREHOLE SEPARATION	20 FT ON CENTER
NUMBER OF CIRCUITS	3
FUTURE CIRCUIT SUPPLY AND RETURNS	NONE
* SOIL THERMAL CONDUCTIVITY	2.0 BTU/H-FT-°F
*SOIL DIFFUSIVITY	1.4 FT^2/DAY
*UNDISTURBED GROUND TEMEPRATURE	53.7°F
GHX PRESSURE DROP	27 FT
SYSTEM FLUID INFORMATION	
TOTAL FLOW	85 GPM
FLUID	23% PROPYLENE GLYCOL
**GHX VOLUME	-
MINIMUM HEAT PUMP INLET FLUID TEMP	32°F
MAXIMUM HEAT PUMP INLET FLUID TEMP	90°F
GROUT INFORMATION	
GROUT TYPE	THERMALLY ENHANCED BENTONITE
NMINIMUM THERMAL CONDUCTIVITY	1.2 BTU/H-FT-°F
FLUSH & PURGE INFORMATION	
MINIMUM FLUID VELOCITY	2.0 FT/SEC
MINIMUM PURGE FLOW (PER CIRCUIT)	40 GPM
PURGE PRESSURE DROP (PER CIRCUIT)	61 FT
GHX CAPACITY INFORMATION	
PEAK HEATING	338 MBH
PEAK COOLING	195 MBH
HEATING EFLH	961 HOURS
COOLING EFLH	423 HOURS

* GIVEN VALUES ARE BASED ON FTC TESTS COMPLETED SEPTEMBER 1-3, 2023
** GHX TOTAL VOLUME TO BE CALCULATED BY GEOTHERMAL CONTRACTOR BASED ON AS-BUILT CONFIGURATION.

DRILL LOG FROM FTC TEST

FORMATION DESCRIPTION	DEPTH
CLAY	0'-50'
CLAY AND GRAVEL	50'-65'
CLAR	65'-80'
SHALE WITH LAYERS OF SANDSTONE	80'-560'
-	-
-	-
-	-
-	-
-	-

GIVEN VALUES ARE BASED ON FTC TESTS COMPLETED SEPTEMBER 1-3, 2023

KINGSCOTT
KALAMAZOO | CHELSEA | GRAND RAPIDS | ROYAL OAK

Willow School
Lansing School District
1012 W. Willow
Lansing, MI 48915

STATE OF MICHIGAN
STEVEN K. GUNTHER, JR.
ENGINEER
No. 6201067419
LICENSED PROFESSIONAL ENGINEER
01/26/2024

Lansing School District

ISSUANCES	DATE
Bid and Construction	01.26.2024

LSD NO. SB-0059
JOB NO. 2616.01A

SHEET TITLE
GEOTHERMAL DETAILS

SHEET NO.
GHX5.0

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