Lansing School District
Wexford Montessori Academy Addition Bid Package 1

Addendum 02

December 05, 2025

This document is to serve as Addendum No. 02 with the purpose of providing clarifications or modifications to the original bid documents dated November 07, 2025 and shall take precedence over them. All incidental items required for the following changes are to be included even if not specifically described.

Receipt of this addendum is to be noted on the bid form.

ATTACHMENTS: Specifications: TOC, 072100, 087100, 088700, 127600, 230923, 233713.23, 263213.16, 263600
Drawings: G000, C001, C100, C200, C300, C301, C400, C600, C700, C701, A001, A101, A142, A201, A421, A522, A523, M101, M600, ES002, E602, E603, E801

BID DATE: Bid date remains UNCHANGED.

BID FORM: Bid Form remains UNCHANGED.

DRAWINGS: G000, C001, C100, C200, C300, C301, C400, C600, C700, C701, A001, A101, A142, A201, A421, A522, A523, M101, M600, ES002, E602, E603, E801.

TECH SPECS: TOC, 072100, 087100, 088700, 127600, 230923, 233713.23, 263213.16, 263600

RFI RESPONSES:

Q: In the DDC Spec Section - 230923 - Is a copy and paste from another project, It states the BAS shall be by Trane, project was for the City of Grand Rapids. The controls for the Lansing schools Wexford and in the Lansing schools district are by SC Technologies. Please send clarification and let the mechanicals that are bidding aware to reach out to us for scope and pricing. Please send me a link to Procore so I can access the bid documents.

A: The district wants S.C. Tec controls for these not Trane. They don't want to have to change them if they come with Trane controls. References to Trane will be replaced with S.C. Tec controls in Addendum #2.

Q: Please confirm that both of these RTU's 1 @ 5900 CFM and RTU 2 @ 9000 CFM are to be the same size?

A: Units use the same cabinet size. Addendum #2 will be updating some of the performance requirements of RTU-2.

Q: VAV's do not have a sequence of operation. Please provide sequence. Will the VAV's have reheat? If Hot Water, we will need the GPM of each VAV.

A: Sequence will be added for the VAV's in Addendum #2. No reheat is added to the VAV's.

Q: Section 084523, part 2.3.C calls for the grid pattern "as indicated on drawings." There is no grid pattern shown on the elevations (A201) or the opening schedule (A601). Please clarify.

A: Basis of Design is Kingspan UniGrid, custom grid pattern/no grid as indicated on drawings.

Q: On the elevations (A201), wall section (A324) and opening schedule (A601), the architect calls for "high impact translucent panels", but section 084523, part 2.3.H, calls for 60 ft-lbs of impact resistance, not 230 ft-lbs which is what normally referred to as high impact. Need to confirm if the architect wants 60 ft-lbs impact or 230 ft-lbs impact (high impact).

A: High-Impact Exterior Sheet - 200 ft-lbs - no penetration, High Impact Interior Sheet - 245 ft-lbs - no penetration, Specification section will be updated.

Q: Hardware Groups 06, 07, 08, 09, 11, The referenced hardware sets call for flush pulls by door manufacturer. Full-glass aluminum door manufacturers do not offer flush pulls as standard equipment. Flush pulls are typically seen on FRP doors. Please provide a manufacturer and part number for the doors pulls in these hardware sets.

A: Specification is updated with 10" offset pulls at aluminum exterior doors.

Q: Do you have a plant quantity list that would be able to be shared as it does not show the quantities on the blueprint legend

A: Quantities of plant materials are in plan view, but plant list is updated/reissued to include quantities.

Q: The Emergency Vehicle Access Drive on Drawing C200 shows Grass Pavers by Invisible Solutions and Drawing A010 shows Turfstone Block concrete pavers. Which is it?

A: Grass Pavers on C200 and in specifications are suitable. Additionally, the Fire Marshal has not provided written comments yet. Area of pavers and 'emergency services access' scope may be revised when written comments are received.

Q: I am not seeing a specification for "storm water piping", will PVC be allowed or do they prefer cast iron no hub?

A: Civil specifications provide storm sewer pipe materials and are identified on plans.

Q: Specification Section 042000 – 1.1 B.2 states: "Cavity wall insulation adhered to masonry backup furnished by others." However, the masonry scope currently

shows the mason furnishing the insulation. Please clarify which trade is responsible for providing the cavity insulation. Based on typical assemblies, we would assume the metal panel installer is responsible for the insulation over CMU backup in areas receiving metal panels, especially where their Z-girt system is designed to receive and support that insulation. Please confirm.

A: WC 04A Masonry is responsible for furnishing and installation cavity insulation. (Response by Laux). WC 07B is to furnish and install insulation over CMU receiving metal panels. (Response by Laux)

Q: There is a discrepancy between the contract documents: Spec Section (Bituminous Dampproofing): Requires spray-applied dampproofing. Drawings: Indicate sheet-applied waterproofing at the same locations. These are two different systems with different performance and cost impacts.
Please confirm which product/installation is intended so we can price and proceed accordingly.

A: Spray-applied damp proofing is to be used at masonry locations. References to sheet-applied waterproofing on masonry are removed. Sheet-applied waterproofing is on sheathing and metal studs only.

Q: Specification Section 079100 specifies polystyrene insulation, but the architectural drawings indicate foil-faced polyisocyanurate (polyiso) at the same locations. These are different materials with different R-values, thickness requirements, and cost impacts. Please confirm which insulation type governs for this project.

A: The drawings and specifications are updated to call for un-faced polyiso insulation.

Q: Please provide the brick type, including manufacturer, series, color, and texture, intended for this project. The contract documents do not clearly identify the required brick selection, and this information is necessary for accurate pricing and material availability review.

- Please confirm the following:
  - Brick manufacturer
  - Brick series / product line
  - Color and texture
  - Any special shapes, if required
  - Mortar color, if already selected

A: Brick selection is TBD by the client. Hold allowance of $1.15 each, delivered and unloaded at the site ($7.88 per square foot).

Q: Please provide the Burnished CMU manufacturer, series, color, and texture, intended for this project. The contract documents do not clearly identify the required burnished CMU selection, and this information is necessary for accurate pricing and material availability review.

- Please confirm the following:
  - Burnished CMU manufacturer
  - Color and texture

- Any special shapes, if required

A: Grand Blanc Cement Products, Greystone White

Q: Scope of Work item #12 states that the masonry contractor is to purchase metal flashings to match any adjacent wall finishes from the metal panel supplier. However, the specifications list several steel/manufacturer options, and it's unclear which supplier we are expected to use. To ensure consistency in material type, finish, profile, and color, wouldn't it make more sense for **WC 07B and WC 08B to furnish the required flashings**, with the masonry contractor installing them? This approach ensures all materials come from the same source and eliminates the risk of mismatched finishes. Please advise which supplier should be used or confirm if WC 07B/08B will be providing the flashings for us to install. Please advise which supplier should be used or confirm if WC 07B/08B will be providing the flashings for us to install.

A: This does make sense for WC 07B to furnish base flashing and WC 08B to furnish window sill and head flashings. This will be noted in addendum 2. (Response by Laux)

Q: Item No. 11 of paragraph 3.8 in the attached specifications calls for a Visible Light Transmittance of 11% minimum. It would require an extremely dark "Midnight Gray" tint that would permit almost no visibility from the exterior of the building to obtain that VLT value. Item No. 5 of the same paragraph calls for "Gray as required to match existing facility glazing". After visiting the site, I'm sure the existing insulated glass is a standard Gray tint that would obtain about 34% visible light transmittance. If we're to bid glass that will meet the 11% VLT, it will not match the existing facility glazing. Which is more important, to match the existing glass or to meet the Visible Light Transmittance requirement?

A: 11% specified is minimum acceptable VLT. Matching the existing facility glazing is the design goal: anything over 11% VLT that matches is acceptable.

PROJECT MANUAL: **WC 04A: DELETE** furnishing of metal flashing at windows and base, this WC to receive flashing materials from WC 07B & WC 08A for installation.

WC 07B: Furnish base flashing material to match adjacent metal wall panels and turnover to WC 04A for installation. Coordinate during shop drawing review.

WC 08A: Furnish window sill and head flashing material to match aluminum finishes and turnover to WC 04A for installation.

SPECIFICATION MODS/ADDS:

Table of Contents (Re-Issued):
Section additions as indicated in ***bold-italics***.

072100 – Thermal Insulation (Re-Issued):
Section additions as indicated in ***bold-italics***.
Section deletions as indicated by ***strikethrough.***

087100 – Door Hardware (Reissued):
Section changes as indicated to exterior aluminum door pulls, per RFI below.

088700 – Glazing Surface Film (Reissued):
Section additions as indicated in ***bold-italics***.
Section deletions as indicated by ***strikethrough.***

127600 – Gymnasium Bleachers (Reissued):
Section additions as indicated in ***bold-italics***.
Section deletions as indicated by ***strikethrough.***

230923 – Direct Digital Control (DDC) System for HVAC (Reissued):
Section edits as indicated in ***bold-italics***.

233713.23 – Registers and Grilles (Reissued):
Section additions as indicated in ***bold-italics***.

263213.16 Gaseous Emergency Engine Generators (Issued):
Section issued in its entirety.

263600 – Transfer Switches (Issued):
Section issued in its entirety.

DRAWING MODS:

G000 – COVER SHEET (Reissued):
Added number A-1 and E-1 to listed architectural and electrical alternates; alternates are unchanged.

C001 – TOPOGRAPHIC BOUNDARY SURVEY (Reissued):
Add note identifying existing underdrain and storm sewer pipe & outlet control structure has been added to remainder of plans as reflected in record drawings recently provided by Owner.

C100 – DEMOLITION PLAN (Reissued):
Revise to reflect existing storm sewer pipe and outlet control structure shown on record plans.
Revise to show existing pavement to remain

C200 – SITE PLAN (Reissued):
Revise to show existing pavement to remain

C300 – GRADING & DRAINAGE PLAN (Reissued):
Revise to show existing pavement to remain
Revise cross section of existing detention basin to align with existing storm sewer shown in record plans.

C301 – SESC PLAN (Reissued):
Revise to show existing pavement to remain.

C400 – UTILITY PLAN (Reissued):
Revise to show existing pavement to remain
Add note regarding coordination with BWL as required during installation of storm sewer at crossing with existing electrical service.

C600 – LANDSCAPE PLAN (Reissued):
Revise to show existing pavement to remain and adjust limits of restoration

C700 – SITE DETAILS (Reissued):
Remove outlet control structure detail
Add existing light duty pavement section from record plans
Add existing medium duty pavement section from record plans
Revise all pavement sections to include non-woven geotextile fabric above existing subgrade

C701 – SITE DETAILS (Reissued):
Revise basketball backstop detail to match record drawings, moved from Sheet C700
Add basketball key detail, relocated from Sheet C700
A001 – GENERAL NOTES AND LEGENDS (Reissued):
Exterior wall section details updated per general comment above.
A101 – FIRST FLOOR PLAN (Reissued):
Added notes and dimensions to identify removable volleyball posts in floor sleeves.
A142 – ENLARGED FINISH PLAN AND DETAILS (Reissued):
Added notes to identify removable volleyball posts in floor sleeves.
A201 – EXTERIOR ELEVATIONS (Reissued):
Updated exterior materials schedule with basis of design finish selections and suggested allowance for brick veneer.
A421 – INTERIOR ELEVATIONS (Reissued):
Details 2, 3, 5: Added additional information for client preferences on toilet partition heights and configurations.
A522 – SECTION DETAILS (Reissued):
Detail 3: Removed redundant self-adhered flashing beneath thru wall flashing.
A523 – SECTION DETAILS (Reissued):
Detail 2: Added graphic representation of 2" continuous insulation, previously noted but not shown.
Added Detail 13 – Volleyball Sleeve Detail.
M101 – 1ST FLOOR HVAC PLAN (Reissued):
RTU-2 return duct dimensions updated to reflect increased airflow.
RG2 sizing and quantity updated to reflect increased airflow.
Fire damper tagged (Gym Storage 108).
Section view detail added to sheet, showing mounting height and sizing for RG2 grilles.
M600 – HVAC SCHEDULES (Reissued):
RTU-2 specifications updated to reflect increased airflow and cooling capacity.
Sequence of Operations updated to include VAV Boxes per RFI below.
ES002 – ELECTRICAL SITE PLAN (Reissued):
Keynote P12 and P13 added to drawings.
E602 – DETAILS (Reissued):
Do not provide hard wired connection to wireless lighting loads from room controller.
Provide hard wired connection to exhaust fan from room controller.
E603 – DETAILS (Reissued):
Do not provide hard wired connection to wireless lighting loads from room controller.
Do not provide occupancy sensor for room controller.
E801 – SCHEDULES (Reissued):
Load revised for RTU-2.
Revised circuits 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84.
Removed shunt trip note.
Do not provide shunt trip breaker.
Revised Gym Storage lighting sequence of operations.

END OF ADDENDUM 02

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. ***Polyisocyanurate foam-plastic board insulation.***
3. Glass-fiber blanket insulation.

B. Related Requirements:

1. ~~***Section 072119 "Foamed-In-Place Insulation" for spray-applied foam insulation.***~~
2. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. ***Polyisocyanurate foam-plastic board insulation.***
3. Glass-fiber blanket insulation.

1.3 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 until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type X (***Below Grade*** Rigid Insulation, Vertical applications): ASTM C578, Type X, 15-psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. DiversiFoam Products.
    b. Dow Chemical Company (The).
    c. MBCI.
    d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Extruded Polystyrene Board Insulation, Type VII (***Below Grade*** Rigid Insulation, Horizontal applications): ASTM C578, Type VII, 60-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. DiversiFoam Products.
    b. Dow Chemical Company (The).
    c. Kingspan Insulation Limited.
    d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2 (Above Grade and Cavity Wall Rigid Insulation, Vertical applications).

1. Manufacturers***: Subject to compliance with requirements, provide products by one of the following:***

a. Atlas Polyiso Roof and Wall Insulation
b. Carlisle Coatings & Waterproofing Inc
c. DuPont de Nemours, Inc.
d. Elevate; Holcim Building Envelope
e. Johns Manville; a Berkshire Hathaway company.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Kraft Faced (Fiberglass Batt): ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or 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.

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. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. 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.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions in small gaps and tight spaces where Glass-Fiber Insulation cannot be installed.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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

SECTION 084523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:

1. Wall assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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 aluminum components of panel assemblies.

B. Shop Drawings: For panel assemblies.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.

C. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Fiberglass-sandwich panels.
5. Flashing and drainage.

D. Delegated Design Submittals: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies 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. Deterioration of metals[, metal finishes,] and other materials beyond normal weathering.
c. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.

1. Defects include, but are not limited to, the following:

a. Fiberbloom.
b. Delamination of coating, if any, from exterior face sheet.
c. Color change exceeding requirements.
d. Delamination of panel face sheets from panel cores.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
2. Warranty Period: 20 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 fiberglass-sandwich-panel assemblies.

B. Structural Loads: As indicated on Drawings.

C. Deflection Limits:

1. Vertical Panel Assemblies: Limited to 1/60 of clear span for each assembly component.

D. Structural-Test Performance: Provide panel assemblies tested in accordance with ASTM E330, as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
2. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. .

F. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested in accordance with AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

G. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. 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.

H. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas to have U-factor of not more than 0.08 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas to have a SHGC of no greater than 0.6 as determined in accordance with NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined in accordance with ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ***Kingspan UniGrid 4"*** panels or comparable products by one of the following:

   a. ***Kalwall Corporation.***
   b. Major Industries, Inc.

2.3 FIBERGLASS-SANDWICH PANELS

A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

1. Core Insulation: Fill panel cores with fiberglass batt (U-Value equal 0.08).

B. Panel Thickness: 4 inches.

C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.

1. Extruded Aluminum: ASTM B221, in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: Thermally broken, extruded aluminum.
3. Grid Pattern: As indicated on Drawings.

D. Exterior Face Sheet:

1. Color: White .
2. Protective Weathering Surface: Manufacturer's standard.

E. Interior Face Sheet:

1. Color: White .

F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

G. Panel Strength:

1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested in accordance with ASTM E72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk in accordance with ASTM E661.

H. Panel Performance:

1. Self-Ignition Temperature: 650 deg F or more in accordance with ASTM D1929.
2. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
3. Combustibility Classification: Class CC1 based on testing in accordance with ASTM D635.
4. Interior Finish Classification: Class A based on testing in accordance with ASTM E84.
5. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.

    a. Outdoor Weathering Conditions: Sixty months in southern Florida.

6. Impact Resistance:

a. Exterior Sheet: High-Impact Sheet - 200 ft-lbs - no penetration.
b. ***Interior Sheet: High-Impact Interior Sheet: 245 ft-lbs - no penetration / Class "A" Sheet.***

7. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.4 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M orASTM A153/A153Mrequirements.

F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard.

J. Frame-System Sealants: As recommended in writing by manufacturer.

1. Sealant shall have a VOC content of 250 g/L or less.

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

A. Frame System Fabrication:

1. Fabricate components that, when assembled, have the following characteristics:

a. Profiles that are sharp, straight, and free of defects or deformations.
b. Accurately fitted joints with ends coped or mitered.
c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.

2. Fabricate sill closures with weep holes and for installation as continuous component.
3. Reinforce components as required to receive fastener threads.

B. Panel Fabrication: Factory assemble and seal panels.

1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.

2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two -coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas 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: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true in alignment with established lines and elevations.

D. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies to be tested in accordance with AAMA 501.2 and to not show evidence of water penetration.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware.
2. Electronic access control system components.
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

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 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
8. 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: 10 years
2) Exit Devices
a) Von Duprin: 10 years
3) Closers
a) LCN 4000 Series: 30 years
4) Automatic Operators
a) LCN: 2 years

b. Electrical Warranty
1) Exit Devices
a) Von Duprin: 3 years

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. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. 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.

D. 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 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.
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.

2.07 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.

2.08 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.

2.09 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
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.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
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.

2.16 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.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
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.

2.18 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.

2.19 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.

2.20 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.

2.21 FINISHES

A. Finish: Generally, Satin Chromium, BHMA 626/652 (US26D). Provide finish for each item as indicated in the sets.

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 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 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. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.

M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Overhead Stops/Holders: Mount overhead stopes/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. 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.

P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

Q. 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.

R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 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.

3.05 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.

3.06 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):
102

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 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	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
1	EA	GASKETING	488S		BK	ZER
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM ELECTRIC STRIKE TO POWER SUPPLY	↯		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR	↯		
1	EA	POWER SUPPLY	PS902 900-4R - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER	↯		VON

NOTES:
1) POWER SUPPLY SHARED WITH DOORS 103 AND 104.

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 UNLOCK THE ELECTRIC STRIKE ALLOWING ACCESS. DOOR TO REMAIN LOCKED UPON LOSS OF POWER, ACTIVATION OF THE FIRE ALARM, OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 02

For use on Door #(s):
103 104

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 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	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
1	EA	GASKETING	488S		BK	ZER
1	EA	WIRE HARNESS	CON-192P - WIRE EXTENSION FROM ELECTRIC STRIKE TO POWER SUPPLY	✓		SCH
1	EA	CARD READER	PROVIDED BY ACCESS CONTROL CONTRACTOR	✓		

NOTES:
1) POWER SUPPLY LISTED WITH DOORS 102.

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 UNLOCK THE ELECTRIC STRIKE ALLOWING ACCESS. DOOR TO REMAIN LOCKED UPON LOSS OF POWER, ACTIVATION OF THE FIRE ALARM, OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 03

For use on Door #(s):
101A

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	FIRE EXIT HARDWARE	9849-EO-F-LBL - AUXILIARY FIRE LATCH (AS REQ'D)	626	VON
1	EA	FIRE EXIT HARDWARE	9849-NL-F-LBL - RHRA	626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)	626	BES
1	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER		BES
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	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

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

THE WALL MAGNETS SHALL BE WIRED TO THE FIRE ALARM PANEL THROUGH A SET OF NORMALLY-CLOSED, DRY CONTACTS (SUPPLIED BY THE FIRE ALARM CONTRACTOR) AND LOCKDOWN SYSTEM (PROVIDED BY OTHERS).

MAGNETIC HOLD OPENS ARE CONTINUOUSLY ENERGIZED ALLOWING THE DOORS TO BE HELD OPEN UNDER NORMAL BUILDING CONDITIONS. WHEN THE FIRE ALARM OR LOCKDOWN SYSTEM IS ACTIVATED, POWER TO THE MAGNETIC HOLD OPENS IS DISCONNECTED CAUSING THE DOOR CLOSERS TO CLOSE THE DOORS. DOORS CAN ALSO BE MANUALLY RELEASED FROM THE MAGNETS.

Hardware Group No. 04

For use on Door #(s):
108 109

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	FIRE EXIT HARDWARE	98-NL-F	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 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. 05

For use on Door #(s):
107A

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 CON	✓	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB		689	VON
1	EA	FIRE EXIT HARDWARE	98-EO-F		626	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-98-NL-F-CON - RHRA	✓	626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)		626	BES
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	GASKETING	488S		BK	ZER
1	EA	MEETING STILE	8217S		BK	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	POWER SUPPLY	PS902 900-2RS - COORDINATE POWER SUPPLY REQUIREMENTS W/SECURITY PROVIDER	✓		VON

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. DOORS TO REMAIN LOCKED UPON LOSS OF POWER, ACTIVATION OF THE FIRE ALARM, OR ACTIVATION OF LOCKDOWN SYSTEM (PROVIDED BY OTHERS). FREE EGRESS AT ALL TIMES.

Hardware Group No. 06

For use on Door #(s):
100B.1 106B.2

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	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
~~1~~	~~EA~~	~~FLUSH PULL~~	~~BY DOOR MANUFACTURER~~			
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. 07

For use on Door #(s):
100B.2 106B.1

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	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
~~1~~	~~EA~~	~~FLUSH PULL~~	~~BY DOOR MANUFACTURER~~			
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	4642	↙	689	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T	↙		LCN
2	EA	SURFACE MOUNT BOX	8310-819S			LCN
1	EA	RELAY/DOOR SEQUENCER	8310-845	↙		LCN
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

OPERATIONAL DESCRIPTION: COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

BOTH ACTUATOR BUTTONS ARE ENABLED WHEN THE OPERATOR IS TURNED ON. PUSHING ENABLED EXTERIOR ACTUATOR WILL CAUSE THE AUTOMATIC OPERATOR TO MOMENTARILY OPEN THE INTERIOR VESTIBULE DOOR. PUSHING ENABLED INTERIOR ACTUATOR WILL CAUSE THE AUTOMATIC OPERATOR TO MOMENTARILY OPEN THE INTERIOR VESTIBULE DOOR AND EXTERIOR VESTIBULE DOOR IN SEQUENCE. FREE EGRESS AT ALL TIMES.

Hardware Group No. 08

For use on Door #(s):
100A.2 106A.1

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	98-NL-OP-110MD		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	ELECTRIC STRIKE	6300 FSE	✓	630	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
~~1~~	~~EA~~	~~FLUSH PULL~~	~~BY DOOR MANUFACTURER~~			
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	4642	✓	689	LCN
1	EA	WEATHER RING	8310-801			LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T	✓		LCN
1	EA	SURFACE MOUNT BOX	8310-819S			LCN
1	EA	RELAY/DOOR SEQUENCER	8310-845	✓		LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T	✓		LCN
1	EA	BOLLARD POST	8310-866			LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	566A		A	ZER
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
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

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 UNLOCK THE ELECTRIC STRIKE (ALLOWING ACCESS) AND ACTIVATE EXTERIOR AUTO OPERATOR ACTUATOR. PUSHING EXTERIOR AUTO OPERATOR ACTUATOR AT THIS TIME WILL SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE EXTERIOR VESTIBULE DOOR AND INTERIOR VESTIBULE DOOR IN SEQUENCE. PUSH INTERIOR ACTUATOR AT ANY TIME WILL MOMENTARILY UNLOCK THE ELECTRIC STRIKE AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE EXTERIOR VESTIBULE DOOR. 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. 09

For use on Door #(s):
101C.1

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	98-NL-OP-110MD		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	ELECTRIC STRIKE	6300 FSE	✓	630	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
~~1~~	~~EA~~	~~FLUSH PULL~~	~~BY DOOR MANUFACTURER~~			
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	4642	✓	689	LCN
1	EA	WEATHER RING	8310-801			LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T	✓		LCN
1	EA	SURFACE MOUNT BOX	8310-819S			LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T	✓		LCN
1	EA	BOLLARD POST	8310-866			LCN
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	566A		A	ZER
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
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

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 UNLOCK THE ELECTRIC STRIKE (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 UNLOCK THE ELECTRIC STRIKE AND SIGNAL AUTO OPERATOR TO MOMENTARILY OPEN THE DOOR. 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. 10

For use on Door #(s):
107B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	PANIC HARDWARE	98-NL-OP-110MD - RHRA		626	VON
1	EA	RIM CYLINDER	1E72 (LESS CORE)		626	BES
1	EA	MORTISE CYLINDER	1E74 (LESS CORE)		626	BES
1	EA	SFIC CONST CORE	80-035 (AS REQ'D)			SCH
2	EA	PERMANENT CORE	CONTRACTOR SUPPLIED - TO BE COMBINATED BY OWNER			BES
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		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	566A		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. 11

For use on Door #(s):
100A.1 101C.2 106A.2

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
~~1~~	~~EA~~	~~FLUSH PULL~~	~~BY DOOR MANUFACTURER~~			
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	566A		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. 12

For use on Door #(s):
101B

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	98-EO		626	VON
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	566A		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. 13

For use on Door #(s):
EX

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW/SW (SIZE AS REQ'D) NRP - CONFIRM HINGE REQ. TO MATCH EXISTING FRAME PREPS	652	IVE
1	EA	FIRE EXIT HARDWARE	98-NL-F	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	STRIKE FILLER PLATE	SIZE AS REQ'D		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488S	BK	ZER

NOTES:
1) FIELD VERIFY EXISTING CONDITIONS. VERIFY/COORDINATE PREPS ON EXISTING FRAMES TO ENSURE THE COMPATIBILITY OF NEW HARDWARE PRIOR TO ORDER OF NEW MATERIALS. PROVIDE FIELD MODIFICATIONS AND/OR NECESSARY FILLERS (PAINT TO MATCH WHERE EXISTING IS PREVIOUSLY PAINTED), REINFORCEMENTS AND FASTENERS, COMPATIBLE WITH EXISTING MATERIALS REQUIRED FOR MOUNTING NEW SPECIFIED HARDWARE AND TO COVER EXISTING FRAME PREPARATION (PER NFPA 80 IF APPLICABLE).

Hardware Group No. 14

For use on Door #(s):
110 123

Each to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	LD-OUT-98-EO-WH	626	VON
			BALANCE OF HARDWARE BY GATE MANUFACTURER		

NOTES:
1) VERIFY DOOR HARDWARE COMPATIBILITY WITH GATE MANUFACTURER PRIOR TO ORDER OF MATERIALS.

Hardware Group No. 15

For use on Door #(s):
122

Each to have:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		HARDWARE BY GATE MANUFACTURER		

Hardware Group No. 16

For use on Door #(s):
111

Each to have:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		HARDWARE BY GATE MANUFACTURER		

END OF SECTION 087100

SECTION 088700 GLAZING SURFACE FILM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Security Window Film.

1.2 SUBMITTALS

A. Product Data: Manufacturer's current technical literature on each product to be used, including:

1. Manufacturer's Data Sheets.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

B. Verification Samples: For each film specified, two samples representing actual film color and pattern.

1.3 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.

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.
2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:

a. Name of building.
b. The name and telephone number of a management contact.
c. Type of glass.
d. Type of film and/or film attachment system.
e. Amount of film and/or film attachment system installed.
f. Date of completion.

C. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:

1. Smoke Developed Index: no greater than 450.

D. 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing film according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with security glazing film when ambient and substrate temperature conditions are outside limits permitted by glazing film material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.6 WARRANTY

A. Manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with the requirements, provide the product indicated for each type of film indicated below or comparable product by one of the following:

1. Pre-approved equivalent.

2.2 SAFETY WINDOW FILMS

A. Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.

B. Basis-of-Design Product: Subject to compliance with the requirements, provide ***3M Scotchshield Safety and Security Window Film Ultra S800.***

C. Physical / Mechanical Performance Properties:

1. Film Color: Clear.
2. Thickness: Nominal ***8 mils.***
3. Tensile Strength (ASTM D 882): ***33,000 psi***.
4. Break Strength (ASTM D 882) (Per Inch Width): ***265 lbs***.
5. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
6. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
7. Solar Performance Properties: Film applied to 1/4 Inch thick clear glass.

    a. Visible Light Transmission (ASTM E 903): ***87%.***
    b. Ultraviolet Transmission (ASTM E 903): ***1% or less***.

8. Impact Resistance for Safety Glazing: Tested on 1/4 inch annealed glass.

    a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
    b. Impact Resistance and pressure cycling are performance based tests for Building Envelope Protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996. Contact 3M for specific test details.

~~***9. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.***~~

~~***a. GSA level 3B rating with minimum blast load of 15 psi overpressure and 58 psi*msec blast impulse on 1 inch double pane annealed glass without use of film attachment system.***~~

~~***10. Forced Entry Protection: Independent lab testing according to UL 972 protocol (Multiple Impact Test).***~~

~~***a. Annealed Glass (1/4 inch) - Pass.***~~
~~***b. Tempered Glass (1/4 inch) - Pass.***~~

PART 3 - EXECUTION

3.1 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.

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. Film Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch 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.

3.4 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

SECTION 12760 - GYMNASIUM BLEACHERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fixed gymnasium bleachers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Shop Drawings: ***For fixed stands***.

1. Include plans, elevations, sections, and attachment details.
2. Include load capacities.
3. Show seating layout, aisle widths, row-lettering and seat-numbering scheme, and wheelchair accessibility provisions.

B. Delegated Design Submittals: For fixed gymnasium bleachers, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For the following products prepared on Samples of size indicated below:

1. Decking: 6-inch- (150-mm-) square Samples of finished material.
2. Metal Components: 6-inch- (150-mm-) square Sample of each color and finish indicated.
3. Seating Material: 6-inch- (150-mm-) square Sample of each seating material, color, and finish indicated.
4. Seat Unit: Full-size unit of each type.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: ***For fixed stands to include maintenance manuals***.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Procedures for conducting periodic inspections.
b. Precautions for cleaning materials and methods that could be detrimental to ***fixed-stand*** finishes and performance.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 FIELD CONDITIONS

A. Finished Spaces: Do not deliver or install ***fixed-stand*** finishes in spaces to receive them are complete, including suspended ceilings, floors, and painting.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of **fixed-stand** assembly that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including bench seating and attached components.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Periods: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Fixed bleachers shall withstand the effects of gravity loads, operational loads, and other loads and stresses according to ICC 300 and the following:

1. Vertical live load of 100 PSF, but not less than 120 PLF on both seat boards and footboards.

2. 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.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fixed gymnasium bleachers.

C. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

2.2 FIXED GYMNASIUM BLEACHERS

A. Description of the System

1. The bleacher system shall be comprised of multiple tiered, closed deck fixed seating rows, incorporating the most economical quantity of sections while still complying with all loading requirements.
2. Each bleacher row shall be comprised of risers, seat and deck components, and a complete set of supportive columns and braces.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hussey Seating Company
2. Interkal LLC
3. Irwin Seating Company
4. Royal Stewart Ltd.

C. Row Spacing: 26 inches.

D. Row Rise: one dimension between 11 and 12 inches.

E. Seat Type: Benches.

F. Operation: Fixed.

2.3 COMPONENTS

A. Benches: Seats and skirts:

1. Material: Lumber with transparent finish.

a. Color: As indicated by manufacturer's designations.

2. Bench Height: Not less than 16 inches or more than 18 inches.
3. Bench Depth: 10 inches.

B. Wheelchair-Accessible Seating: Locate aisle seats without armrests, with folding armrests, or with removable armrests to provide wheelchair-accessible seating at locations indicated on Drawings.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by ICC 300.
2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches from finished floor.

C. Deck: Plywood, 5/8 inch thick.

1. Finish: Polyethylene textured overlay bonded to substrate with exterior glue.

a. Color: As indicated by manufacturer's designations.

D. 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.

2.4 ACCESSORIES

A. Steps:

1. Slip-resistant, abrasive tread surfaces at aisles.
2. Intermediate aisle steps, fully enclosed, at each aisle.
3. Transitional top step, fully enclosed, at each aisle where last row of ***fixed-stands*** is adjacent to a cross aisle.
4. Removable front steps, fully enclosed, at each aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.

B. Closure Panels and Void Fillers:

1. Aisle closures at foot level that produce flush vertical face at aisles when system is stored.
2. Panels at cutouts and truncations for accessible seating.

2.5 MATERIALS

A. Lumber: Kiln dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B & B finish (B and better) grade-of-finish requirements.

B. Plywood: PS 1 as standard with manufacturer.

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.

2.6 FABRICATION

A. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

B. Form exposed work with flat, flush surfaces, level and true in line.

C. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.

1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixed gymnasium bleachers in accordance with ICC 300 and manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.

~~B. ***Adjust hardware and moving parts to function smoothly, and lubricate, test, and adjust each telescoping-stand unit to operate in accordance with manufacturer's written instructions.***~~

C. Clean installed ***fixed-stand*** on exposed and semiexposed surfaces. Touch up factory-applied finishes or replace components as required to restore damaged or soiled areas.

~~***D. Replace upholstery fabric damaged during installation or work of other trades.***~~

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, ~~***operate,***~~ and maintain bleachers.

END OF SECTION

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Direct digital control (DDC) system equipment and components for monitoring and controlling of HVAC, exclusive of instrumentation and control devices.

B. Related Requirements:

1. Section 230993.11 "Sequence of Operations for HVAC DDC" for control sequences in DDC systems.

1.2 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems to be capable of operating in a standalone mode using the last best available data.

J. E/P: Voltage to pneumatic.

K. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

L. HLC: Heavy load conditions.

M. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

N. I/P: Current to pneumatic.

O. LAN: Local area network.

P. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

Q. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

R. Modbus TCP/IP: An open protocol for exchange of process data.

S. MS/TP: Master-slave/token-passing, ISO/IEC/IEEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

T. MTBF: Mean time between failures.

U. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

V. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

W. Peer to Peer: Networking architecture that treats all network stations as equal partners.

X. POT: Portable operator's terminal.

Y. RAM: Random access memory.

Z. RF: Radio frequency.

AA. Router: Device connecting two or more networks at network layer.

BB. Server: Computer used to maintain system configuration, historical and programming database.

CC. TCP/IP: Transport control protocol/Internet protocol.

DD. UPS: Uninterruptible power supply.

EE. USB: Universal Serial Bus.

FF. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

GG. VAV: Variable air volume.

HH. WLED: White light emitting diode.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission.
2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.
3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. Product Data:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation, and maintenance instructions including factors effecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.

    a. Workstations.
    b. Printers.
    c. Gateways.
    d. Routers.
    e. Protocol analyzers.
    f. DDC controllers.
    g. Enclosures.
    h. Electrical power devices.
    i. Accessories.
    j. Instruments.
    k. Control dampers and actuators.
    l. Control valves and actuators.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature to clearly cross reference specification and drawings that submittal is to cover.

C. Software Submittal:

1. Cross-referenced listing of software to be loaded on each operator workstation, server, gateway, and DDC controller.
2. Description and technical data of all software provided and cross-referenced to products in which software will be installed.
3. Operating system software, operator interface and programming software, color graphic software, DDC controller software, maintenance management software, and third-party software.
4. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
5. Listing and description of each engineering equation used with reference source.
6. Listing and description of each constant used in engineering equations and a reference source to prove origin of each constant.
7. Description of operator interface to alphanumeric and graphic programming.
8. Description of each network communication protocol.
9. Description of system database, including all data included in database, database capacity, and limitations to expand database.

10. Description of each application program and device drivers to be generated, including specific information on data acquisition and control strategies showing their relationship to system timing, speed, processing burden, and system throughout.
11. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

D. Shop Drawings:

1. General Requirements:

    a. Include cover drawing with Project name, location, Owner, Architect, Contractor, and issue date with each Shop Drawings submission.
    b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
    c. Drawings Size: 17” x 11”.

2. Include plans, elevations, sections, and mounting details where applicable.
3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Detail means of vibration isolation and show attachments to rotating equipment.
5. Plan Drawings indicating the following:

    a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork, and piping.
    b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
    c. Each desktop workstation network port, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
    d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
    e. Network communication cable and raceway routing.
    f. Information, drawn to scale, of 1/8” per foot.
    g. Proposed routing of wiring, cabling, conduit, and tubing; coordinated with building services for review before installation.

6. Schematic drawings for each controlled HVAC system indicating the following:

    a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
    b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
    c. A graphic showing location of control I/O in proper relationship to HVAC system.
    d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.

e. Unique identification of each I/O that to be consistently used between different drawings showing same point.
f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays, and interface to DDC controllers.
g. Narrative sequence of operation.
h. Graphic sequence of operation, showing all inputs and output logical blocks.

7. Control panel drawings indicating the following:

a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates, and allocated spare space.
c. Front, rear, and side elevations and nameplate legend.
d. Unique drawing for each panel.

8. DDC system network riser diagram indicating the following:

a. Each device connected to network with unique identification for each.
b. Interconnection of each different network in DDC system.
c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

9. DDC system electrical power riser diagram indicating the following:

a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
d. Power wiring type and size, race type, and size for each.

10. Monitoring and control signal diagrams indicating the following:

a. Control signal cable and wiring between controllers and I/O.
b. Point-to-point schematic wiring diagrams for each product.
c. Control signal tubing to sensors, switches, and transmitters.
d. Process signal tubing to sensors, switches, and transmitters.

11. Color graphics indicating the following:

a. Itemized list of color graphic displays to be provided.
b. For each display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.

c. Intended operator access between related hierarchical display screens.

E. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing, and events that initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:

   a. Loss of power.
   b. Loss of network communication signal.
   c. Loss of controller signals to inputs and outpoints.
   d. Operator workstation failure.
   e. Server failure.
   f. Gateway failure.
   g. Network failure.
   h. Controller failure.
   i. Instrument failure.
   j. Control damper and valve actuator failure.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
2. 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.

B. Qualification Statements:

1. Systems Provider's Qualification Data:

   a. Resume of project manager assigned to Project.
   b. Resumes of application engineering staff assigned to Project.
   c. Resumes of installation and programming technicians assigned to Project.
   d. Resumes of service technicians assigned to Project.
   e. Brief description of past project including physical address, floor area, number of floors, building system cooling and heating capacity, and building's primary function.

f. Description of past project DDC system, noting similarities to Project scope and complexity indicated.
g. Names of staff assigned to past project that will also be assigned to execute work of this Project.
h. Owner contact information for past project including name, phone number, and email address.
i. Contractor contact information for past project including name, phone number, and email address.
j. Architect and Engineer contact information for past project including name, phone number, and email address.

2. Manufacturer's qualification data.
3. Testing agency's qualification data.

C. Product Certificates:

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to do the following:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and databases on electronic media.
j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.
n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials and parts to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include product manufacturers' recommended parts lists for proper product operation over four-year period following warranty period. Parts list to be indicated for each year.

C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during two-year period following warranty period.

D. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:

1. Network Controller: One.
2. Programmable Application Controller: One.
3. Application-Specific Controller: One.
4. General-Purpose Relay: One.
5. Current-Sensing Relay: One.
6. DC Power Supply: One.

1.8 QUALITY ASSURANCE

A. DDC System Manufacturer Qualifications:

1. DDC system shall be provided ***through SC Technologies***.

B. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, ***SC Technologies***.

2. Demonstrate past experience with installation of DDC system products being installed for period within three consecutive years before time of bid.
3. Demonstrate past experience on five projects of similar complexity, scope, and value.
4. Demonstrate past experience of each person assigned to Project.
5. Service and maintenance staff assigned to support Project during warranty period.
6. Product parts inventory to support ongoing DDC system operation for a period of not less than five years after Substantial Completion.
7. DDC system manufacturer's backing to take over execution of the Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Adjust, repair, or replace failures at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.

    a. Install updates only after receiving Owner's written authorization.

3. Perform warranty service during normal business hours and commence within 24 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.

    a. For Gateway: Two-year parts and labor warranty for each.

PART 2 - PRODUCTS

2.1 DDC SYSTEM DESCRIPTION

A. The BAS system shall be by ***SC Technologies. A BACnet controller shall be provided for the new building addition and shall interface with the existing building management system. The system shall consist of open protocol BACnet MSTP communication wired to BACnet MSTP unit controllers for all equipment. Where applicable factory mounted unit controllers with factory mounted end devices shall be provided for the HVAC equipment. Each unit controller shall be programmed and tested according to the specified control sequences. The control system shall be integrated into the existing BMS operator interface.***

B. 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.

2.2 WEB ACCESS

A. DDC system to be web compatible.

1. Web-Compatible Access to DDC System:

a. Workstation and server to perform overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
b. DDC system to support web browser access to building data. Operator using a standard web browser is able to access control graphics and change adjustable set points.
c. Password-protected web access.

2.3 PERFORMANCE REQUIREMENTS

A. ASME Compliance:

1. DDC system for monitoring and controlling of HVAC systems.

B. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

C. Delegated Design, Qualified Professional: Engage a qualified professional to design DDC system to satisfy requirements indicated.

1. System Performance Objectives:

a. DDC system manages HVAC systems.
b. DDC system operates HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.

c. DDC system responds to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
d. DDC system operates while unattended by an operator and through operator interaction.
e. DDC system records trends and transactions of events and produces report information such as performance, energy, occupancies, and equipment operation.

D. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths complying 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: 50 or less.

E. DDC System Speed:

1. Response Time of Connected I/O:

a. Update AI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
b. Update BI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
c. AO points connected to DDC system to begin to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
d. BO point values connected to DDC system to respond to controller output commands within two second(s). Global commands to also comply with this requirement.

2. Display of Connected I/O:

a. Update and display analog point COV connected to DDC system at least every 10 seconds for use by operator.
b. Update and display binary point COV connected to DDC system at least every 10 seconds for use by operator.
c. Update and display alarms of analog and digital points connected to DDC system within 45 seconds of activation or change of state.
d. Update graphic display refresh within eight seconds.
e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations to not exceed graphic refresh rate indicated.

F. Network Bandwidth: Design each network of DDC system to include spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions. Minimum spare bandwidth as follows:

1. Level 1 Networks: 20.
2. Level 2 Networks: 20.
3. Level 3 Networks: 30.

G. DDC System Data Storage:

1. Include capability to archive not less than 24 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends, and other information indicated.
2. Local Storage:

    a. Provide server with data storage indicated. Server(s) to use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.

3. Cloud Storage:

    a. Provide application-based and web browser interfaces to configure, upload, download, and manage data and to service plan with storage adequate to store all data for term indicated. Cloud storage uses IT industry standard database platforms and is capable of functions described in "DDC Data Access" Paragraph.

H. Future Expandability:

1. DDC system size is expandable to an ultimate capacity of at least 1.5 times total I/O points indicated.
2. Design and install system networks to achieve ultimate capacity with only addition of DDC controllers, I/O, and associated wiring and cable. Design and install initial network infrastructure to support ultimate capacity without having to remove and replace portions of network installation.
3. Operator interfaces installed initially do not require hardware and software additions and revisions for system when operating at ultimate capacity.

I. Input Point Values Displayed Accuracy: Meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.

1. Energy:

    a. Thermal: Within 3 percent of reading.
    b. Electric Power: Within 1 percent of reading.
    c. Requirements indicated on Drawings for meters not supplied by utility.

2. Flow:

    a. Air: Within 2 percent of design flow rate.
    b. Air (Terminal Units): Within 5 percent of design flow rate.
    c. Natural Gas: Within 2 percent of design flow rate.
    d. Water: Within 2 percent of design flow rate.

3. Gas:

    a. Carbon Dioxide: Within 50 ppm.
    b. Carbon Monoxide: Within 5 percent of reading.

4. Level: Within 5 percent of reading.
5. Pressure:

    a. Air, Ducts and Equipment: 1 percent of instrument range.
    b. Space: Within 1 percent of instrument range.
    c. Water: Within 1 percent of instrument range.

6. Speed: Within 5 percent of reading.
7. Temperature, Dry Bulb:

    a. Air: Within 1 deg F.
    b. Space: Within 1 deg F.
    c. Outdoor: Within 2 deg F.

J. Precision of I/O Reported Values: Values reported in database and displayed to have following precision:

1. Current:

    a. Milliamperes: Nearest 1/100th of a milliampere.
    b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.

2. Energy:

    a. Electric Power:

        1) Rate (Watts): Nearest 1/10th of a watt through 1000 W.
        2) Rate (Kilowatts): Nearest 1/10th of a kilowatt through 1000 kW; nearest kilowatt above 1000 kW.
        3) Usage (Kilowatt-Hours): Nearest kilowatt through 10,000 kW; nearest 10 kW between 10,000 and 100,000 kW; nearest 100 kW for above 100,000 kW.

    b. Natural Gas (Usage): Nearest 1/10th of a unit (cubic feet, MCF, therm) up to 100 units; nearest unit for above 100 units.
    c. Thermal, Rate:

        1) Heating: For British thermal units per hour, nearest British thermal unit per hour up to 1000 Btu/h; nearest 10 Btu/h between 1000 and 10,000 Btu/h; nearest 100 Btu/h for above 10,000 Btu/h. For MBh, round to nearest MBh up to 1000 MBh; nearest 10 MBh between 1000 and 10,000 MBh; nearest 100 MBh above 10,000 MBh.
        2) Cooling: For tons, nearest ton up to 1000 tons; nearest 10 tons between 1000 and 10,000 tons; nearest 100 tons above 10,000 tons.

d. Thermal, Usage:

1) Heating: For British thermal unit, nearest British thermal unit up to 1000 Btu; nearest 10 Btu between 1000 and 10,000 Btu; nearest 100 Btu for above 10,000 Btu. For MBtu, round to nearest MBtu up to 1000 MBtu; nearest 10 MBtu between 1000 and 10,000 MBtu; nearest 100 MBtu above 10,000 MBtu.
2) Cooling: For ton-hours, nearest ton-hours up to 1000 ton-hours; nearest 10 ton-hours between 1000 and 10,000 ton-hours; nearest 100 tons above 10,000 tons.

3. Flow:

a. Air: Nearest 1/10th of a cubic feet per minute through 100 cfm; nearest cubic feet per minute between 100 and 1000 cfm; nearest 10 cfm between 1000 and 10,000 cfm; nearest 100 cfm above 10,000 cfm.
b. Natural Gas:Nearest 1/10th of a cubic feet per hour through 100 cfh; nearest cubic feet per hour between 100 and 1000 cfh; nearest 10 cfh between 1000 and 10,000 cfh; nearest 100 cfh above 10,000 cfh.
c. Water: Nearest 1/10th of a gallon per minute through 100 gpm; nearest gallon per minute between 100 and 1000 gpm; nearest 10 gpm between 1000 and 10,000 gpm; nearest 100 gpm above 10,000 gpm.

4. Gas:

a. Carbon Dioxide (ppm): Nearest ppm.
b. Carbon Monoxide (ppm): Nearest ppm.

5. Moisture (Relative Humidity):

a. Relative Humidity (Percentage): Nearest 1 percent.

6. Level: Nearest 1/100th of an inch through 10 inches; nearest 1/10 of an inch between 10 and 100 inches; nearest inch above 100 inches.
7. Speed:

a. Rotation (rpm): Nearest 1 rpm.
b. Velocity: Nearest 1/10th of feet per minute through 100 fpm; nearest feet per minute between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.

8. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
9. Pressure:

a. Air, Ducts and Equipment: Nearest 1/10th of an inch water closet.
b. Space: Nearest 1/100th of an inch water closet.
c. Water: Nearest 1/10 of a pound per square inch gauge through 100 psig; nearest pound per square inch gauge above 100 psig.

10. Temperature:

a. Air, Ducts and Equipment: Nearest 1/10th of a degree.

b. Outdoor: Nearest degree.
c. Space: Nearest 1/10th of a degree.
d. Heating Hot Water: Nearest degree.

11. Voltage: Nearest 1/10 V up to 100 V; nearest volt above 100 V.

K. Control Stability: Control variables indicated within the following limits:

1. Flow:

a. Air, Ducts and Equipment, except Terminal Units: Within 5 percent of design flow rate.
b. Air, Terminal Units: Within 10 percent of design flow rate.
c. Water: Within 2 percent of design flow rate.

2. Gas:

a. Carbon Dioxide: Within 50 ppm.
b. Carbon Monoxide: Within 5 percent of reading.

3. Level: Within 5 percent of reading.
4. Pressure:

a. Air, Ducts and Equipment: 1 percent of instrument range.
b. Space: Within 1 percent of instrument range.
c. Water: Within 1 percent of instrument range.
d. Steam: Within 1 percent of instrument range.

5. Temperature, Dry Bulb:

a. Air: Within 2 deg F.
b. Space: Within 2 deg F.
c. Heating Hot Water: Within 2 deg F.

L. Environmental Conditions for Controllers, Gateways, and Routers:

1. Products to operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.

a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure to be internally insulated, electrically heated, cooled, and ventilated as required by product and application.

2. Protect products with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House products not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location dictates the following NEMA 250 enclosure requirements:

a. Outdoors, Protected: Type 2.
b. Outdoors, Unprotected: Type 4.
c. Indoors, Heated with Filtered Ventilation: Type 1.
d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
e. Indoors, Heated and Air-Conditioned: Type 1.
f. Localized Areas Exposed to Washdown: Type 4X Insert type.
g. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
h. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4X.
i. Hazardous Locations: Explosion-proof rating for condition.

M. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators to operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure is internally insulated, electrically heated, and ventilated as required by instrument and application.

2. Protect instruments, actuators, and accessories with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House instruments and actuators not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location is to dictate the following NEMA 250 enclosure requirements:

a. Outdoors, Protected: Type 2.
b. Outdoors, Unprotected: Type 4X.
c. Indoors, Heated with Filtered Ventilation: Type 1.
d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
e. Indoors, Heated and Air-conditioned: Type 1.
f. Localized Areas Exposed to Washdown: Type 4X.
g. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
h. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4X Insert type.
i. Hazardous Locations: Explosion-proof rating for condition.

N. Backup Power Source:

1. Serve DDC system products that control HVAC systems and equipment served by a backup power source also from a backup power source.

O. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems are to automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.4 PANEL-MOUNTED, MANUAL OVERRIDE SWITCHES

A. Manual Override of Control Dampers:

1. Include panel-mounted, two-position, selector switch for each automatic control damper being controlled by DDC controller.
2. Label each switch with damper designation served by switch.
3. Label switch positions to indicate either "Manual" or "Auto" control signal to damper.
4. With switch in "Auto" position, control signal to damper actuator with control loop output signal from DDC controller.
5. With switch in "Manual" position, control signal to damper actuator at panel with either an integral or a separate switch to include local control.

    a. For Binary Control Dampers: Manual two-position switch with "Close" and "Open" switch positions indicated. With switch in "Close" position, close damper. With switch in "Open" position, open damper.
    b. For Analog Control Dampers: A gradual switch with "Close" and "Open" switch limits indicated. Operator switches knob to adjust damper to any position from close to open.

6. DDC controller to monitor and report position of each manual override selector switch. With switch placed in "manual" position, DDC controller to signal an override condition to alert operator that damper is under manual, not automatic, control.
7. Configure manual override switches to allow operator to manually operate damper while at panel without DDC controller installed and operational.
8. Terminal equipment including VAV units, unit heaters do not require manual override unless otherwise indicated by sequence of operation.

B. Manual Override of Control Valves:

1. Include panel-mounted, two-position, selector switch for each automatic control valve being controlled by DDC controller.
2. Label each switch with valve designation served by switch.
3. Label switch positions to indicate either "Manual" or "Auto" control signal to valve.
4. With switch in "Auto" position, control signal to valve actuator with a control loop output signal from DDC controller.
5. With switch in "Manual" position, control signal to valve actuator at panel with either an integral or a separate switch to include local control.

a. For Binary Control Valves: Manual two-position switch with "Close" and "Open" switch positions indicated. With switch in "Close" position, close valve. With switch in "Open" position, open valve.
b. For Analog Control Valves: A gradual switch with "Open" and "Close" switch limits indicated. Operator rotates switch knob to adjust valve to any position from close to open.

6. DDC controller to monitor and report position of each manual override selector switch. With switch placed in "manual" position, DDC controller to signal an override condition to alert operator that valve is under manual, not automatic, control.
7. Configure manual override switches to allow operator to manually operate valve while at panel without DDC controller installed and operational.
8. Terminal equipment including VAV units, and unit heaters do not require manual override unless otherwise indicated by sequence of operation.

2.5 SYSTEM ARCHITECTURE

A. System architecture consisting of no more than three levels of LANs.

1. Level 2 LAN: Connect network controllers and operator workstations.
2. Level 1 LAN: Connect programmable application controllers to other programmable application controllers and to network controllers.
3. Level 3 LAN: Connect application-specific controllers to programmable application controllers and to network controllers.

B. Minimum Data Transfer and Communication Speed:

1. LAN Connecting Operator Workstations and Network Controllers: 100 Mbps.
2. LAN Connecting Programmable Application Controllers: 1000 kbps.
3. LAN Connecting Application-Specific Controllers: 76,800 38,400 19,200 Insert value bps.

C. Provide dedicated and separated DDC system LANs that are not shared with other building systems and tenant data and communication networks.

D. Provide modular system architecture with inherent ability to expand to not less than 1.5 times system size indicated with no impact to performance indicated.

E. Configure architecture to eliminate or minimize need to remove and replace existing network equipment for system expansion.

F. Make number of LANs and associated communication transparent to operator. Configure all I/O points residing on any LAN to be capable of global sharing between all system LANs.

G. Design system to eliminate dependence on any single device for system alarm reporting and control execution. Design each controller to operate independently by performing own control, alarm management, and historical data collection.

H. Special Network Architecture Requirements:

1. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units connected directly to controller that is controlling air-handling-system air-handling unit(s). Basically, create DDC system LAN that aligns with air-handling system being controlled.

2.6 DDC SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access: Operator able to access entire DDC system through any of multiple means including, but not limited to, the following:

1. Desktop and portable workstation with hardwired connection through LAN port.
2. Mobile device and application with secured wireless connection through LAN router or cellular data service.
3. Remote connection through web access.

B. Make access to system, regardless of operator means used, transparent to operator.

C. Network Ports: For hardwired connection of desktop or portable workstation. Network port easily accessible, properly protected, clearly labeled, and installed at the following locations:

1. To be determined by Owner.

D. Desktop Workstations:

1. Able to communicate with any device located on any DDC system LAN.

E. Portable Workstations:

1. Able to communicate with any device located on any DDC system LAN.
2. Connect to DDC system Level 2 or Level 3 LAN through a communications port on an application-specific controller, or a room temperature sensor connected to an application-specific controller.
3. Connect to system through a wireless router connected to Level 1 LAN.
4. Connect to system through a cellular broadband data service.
5. Portable workstation able to communicate with any device connected to any system LAN regardless of point of physical connection to system.
6. Monitor, program, schedule, adjust set points, and report capabilities of I/O connected anywhere in system.
7. Have dynamic graphic displays that are identical to desktop workstations.

F. Mobile Device (Tablet and Smart Phone):

1. Connect Owner-furnished mobile devices to system through a wireless router connected to LAN.
2. Able to communicate with any DDC controller connected to DDC system using dedicated application and secure web access.

G. Critical Alarm Reporting:

1. Send operator-selected critical alarms to notify operator of critical alarms that require immediate attention.
2. Send alarm notification to multiple recipients that are assigned for each alarm.
3. Notify recipients by any or all means, including email, text message, and prerecorded phone message to mobile and landline phone numbers.

H. Simultaneous Operator Use: Capable of accommodating up to five simultaneous operators that are accessing DDC system through any of operator interfaces indicated.

2.7 NETWORKS

A. Acceptable networks for connecting workstations, mobile devices, and network controllers include the following:

1. ATA 878.1, ARCNET.
2. IP.
3. ISO/IEC/IEEE 8802-3, Ethernet.

B. Acceptable networks for connecting programmable application controllers include the following:

1. ATA 878.1, ARCNET.
2. IP.
3. ISO/IEC/IEEE 8802-3, Ethernet.

C. Acceptable networks for connecting application-specific controllers include the following:

1. ATA 878.1, ARCNET.
2. TIA 485-A.
3. IP.
4. ISO/IEC/IEEE 8802-3, Ethernet.

2.8 NETWORK COMMUNICATION PROTOCOL

A. Use network communication protocol(s) that are open to Owner and available to other companies for use in making future modifications to DDC system.

B. Industry Standard Protocols:

1. Use any one or a combination of the following industry standard protocols for network communication while complying with other DDC system requirements indicated:

a. ASHRAE 135.
b. Modbus Application Protocol Specification V1.1b3.

2. Operator workstations and network controllers are to communicate through ASHRAE 135 protocol.
3. Provide portions of DDC system networks using ASHRAE 135 communication protocol as an open implementation of network devices complying with ASHRAE 135. Use network devices that are tested and listed by BTL.
4. Provide portions of DDC system networks using Modbus Application Protocol Specification V1.1b3 communication protocol as an open implementation of network devices and technology complying with Modbus Application Protocol Specification V1.1b3.
5. Use gateways to connect networks and network devices with different protocols.

2.9 PORTABLE WORKSTATIONS

A. Description: A self-contained computer designed to allow for normal use in different locations and conditions.

B. Performance Requirements:

1. Performance requirements may dictate equipment exceeding minimum requirements indicated.
2. ENERGY STAR compliant.
3. Hardware and software to support local down-loading to DDC controllers.
4. Data transfer rate to DDC controller is to be at network speed.

C. Processor:

1. Minimum Processor Speed:3.2GHz .
2. RAM:

    a. Capacity: 64GB.
    b. Speed and Type: 3200 MHz,.

3. Hard Drive:

    a. Number of Hard Drives: One.
    b. Capacity:1TB .

4. Video Card: NVIDIA T1200 6GB of RAM.

D. I/O Ports:

1. Serial port.
2. Shared port for external keyboard or mouse.
3. Four USB 3.0 ports.
4. Ethernet port.
5. HDMI port.
6. IEEE 1394 port.

E. Battery:

1. Capable of supporting operation of portable workstation for a minimum of 2 hours.
2. Battery life of at least three years.
3. Battery charge time of less than three hours.

F. Keyboard:

1. 85-key backlit keyboard.
2. Full upper- and lowercase ASCII keyset.

G. Integral Pointing Device: Touchpad with two buttons. Gesture enabled.

H. Display:

1. 17” diagonal or larger high-definition WLED color display.
2. Antiglare screen.
3. 2560 x 1440 pixel resolution.
4. Brightness: 300 nits.

I. Network Interfaces:

1. Network Interface Card: Include card with connection, as application.

a. 10-100-1000 base TX Ethernet with RJ-45 connector port.
b. 100 base FX Ethernet with SC or ST port.

2. Wireless:

a. Internal with integrated antenna, capable of supporting WiFi standards 802.11 a/b/g/n.

J. Accessories:

1. Nylon carrying case.
2. Docking station.
3. Mobile broadband card.
4. Wireless optical mouse.
5. Light-sensitive web cam and noise-cancelling digital array microphone.
6. Category 6a patch cable. Minimum cable length is to be 5’.
7. HDMI cable. Minimum cable length is to be 3’.

2.10 SYSTEM SOFTWARE

A. System Software Minimum Requirements:

1. Real-time multitasking and multiuser 64-bit operating system that allows concurrent multiple operator workstations operating and concurrent execution of multiple real-time programs and custom program development.
2. Operating system capable of operating DOS and Microsoft Windows applications.

3. Database management software to manage all data on an integrated and non-redundant basis. Additions and deletions to database are to be without detriment to existing data. Include cross linkages so no data required by a program can be deleted by an operator until that data have been deleted from respective programs.
4. Network communications software to manage and control multiple network communications to provide exchange of global information and execution of global programs.
5. Operator interface software to include day-to-day operator transaction processing, alarm and report handling, operator privilege level and data segregation control, custom programming, and online data modification capability.
6. Scheduling software to schedule centrally based time and event, temporary, and exception day programs.

B. Operator Interface Software:

1. Minimize operator training through use of English language prorating and English language point identification.
2. Minimize use of a typewriter-style keyboard through use of a pointing device similar to a mouse.
3. Make operator sign-off a manual operation or, if no keyboard or mouse activity takes place, an automatic sign-off.
4. Make automatic sign-off period programmable from one to 60 minutes in one-minute increments on a per operator basis.
5. Record operator sign-on and sign-off activity and send to printer.
6. Security Access:

    a. Use password control for operator access to DDC system.
    b. Assign an alphanumeric password (field assignable) to each operator.
    c. Grant operators access to DDC system by entry of proper password.
    d. Use same operator password regardless of which computer or other operator interface means are used.
    e. Automatically update additions or changes made to passwords.
    f. Assign each operator an access level to restrict access to data and functions the operator is cable of performing.
    g. Provide software with at least five access levels.
    h. Assign each menu item an access level so that a one-for-one correspondence between operator assigned access level(s) and menu item access level(s) is required to gain access to menu item.
    i. Display menu items to operator with those capable of access highlighted. Make menu and operator access level assignments online programmable and under password control.

7. Data Segregation:

    a. Include data segregation for control of specific data routed to a workstation, to an operator or to a specific output device, such as a printer.
    b. Include at least 32 segregation groups.
    c. Make segregation groups selectable such as "fire points," "fire points on second floor," "space temperature points," "HVAC points," and so on.

d. Make points assignable to multiple segregation groups. Display and output of data to printer or monitor is to occur where there is a match of operator or peripheral segregation group assignment and point segregations.
e. Make alarms displayed and printed at each peripheral to which segregation allows, but only those operators assigned to peripheral and having proper authorization level will be allowed to acknowledge alarms.
f. Assign operators and peripherals to multiple segregation groups and make all assignments online programmable and under password control.

8. Operators able to perform commands including, but not limited to, the following:

a. Start or stop selected equipment.
b. Adjust set points.
c. Add, modify, and delete time programming.
d. Enable and disable process execution.
e. Lock and unlock alarm reporting for each point.
f. Enable and disable totalization for each point.
g. Enable and disable trending for each point.
h. Override control loop set points.
i. Enter temporary override schedules.
j. Define holiday schedules.
k. Change time and date.
l. Enter and modify analog alarm limits.
m. Enter and modify analog warning limits.
n. View limits.
o. Enable and disable demand limiting.
p. Enable and disable duty cycle.
q. Display logic programming for each control sequence.

9. Reporting:

a. Generated automatically and manually.
b. Sent to displays, printers and disc files.
c. Types of Reporting:

1) General listing of points.
2) List points currently in alarm.
3) List of off-line points.
4) List points currently in override status.
5) List of disabled points.
6) List points currently locked out.
7) List of items defined in a "Follow-Up" file.
8) List weekly schedules.
9) List holiday programming.
10) List of limits and deadbands.

10. Summaries: For specific points, for a logical point group, for an operator selected group(s), or for entire system without restriction due to hardware configuration.

C. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator. Include at least five levels with the penetration path operator assignable (for example, site, building, floor, air-handling unit, and supply temperature loop). Native language descriptors assigned to menu items are to be operator defined and modifiable under password control.
2. Include a hierarchical-linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. Interface is to use a pointing device with pull-down or penetrating menus, color, and animation to facilitate operator understanding of system.
3. Include at least 10 levels of graphic penetration with the hierarchy operator assignable.
4. Make descriptors for graphics, points, alarms, and such modifiable through operator's workstation under password control.
5. Make graphic displays online user definable and modifiable using the hardware and software provided.
6. Make data displayed within a graphic assignable regardless of physical hardware address, communication, or point type.
7. Make graphics online programmable and under password control.
8. Make points assignable to multiple graphics where necessary to facilitate operator understanding of system operation.
9. Graphics to also contain software points.
10. Penetration within a graphic hierarchy is to display each graphic name as graphics are selected to facilitate operator understanding.
11. Provide a back-trace feature to permit operator to move upward in the hierarchy using a pointing device. Back trace to show all previous penetration levels. Include operator with option of showing each graphic full-screen size with back trace as horizontal header or by showing a "stack" of graphics, each with a back trace.
12. Display operator accessed data on the monitor.
13. Provide operator with ability to select further penetration using pointing device to click on a site, building, floor, area, equipment, and so on. Display defined and linked graphic below that selection.
14. Include operator with means to directly access graphics without going through penetration path.
15. Make dynamic data assignable to graphics.
16. Display points (physical and software) with dynamic data provided by DDC system with appropriate text descriptors, status or value, and engineering unit.
17. Use color, rotation, or other highly visible means, to denote status and alarm states. Make colors variable for each class of points, as chosen by operator.
18. Provide dynamic points with operator adjustable update rates on a per point basis from one second to over a minute.
19. For operators with appropriate privilege, command points directly from display using pointing device.

    a. For an analog command point such as set point, display current conditions and limits so operator can position new set point using pointing device.
    b. For a digital command point such as valve position, show valve in current state such as open or closed so operator could select alternative position using pointing device.
    c. Include a keyboard equivalent for those operators with that preference.

20. Give operator ability to split or resize viewing screen into quadrants to show one graphic on one quadrant of screen and other graphics or spreadsheet, bar chart, word processing, curve plot, and other information on other quadrants on screen. This feature allows real-time monitoring of one part of system while displaying other parts of system or data to better facilitate overall system operation.
21. Help Features:

    a. Online context-sensitive help utility to facilitate operator training and understanding.
    b. Bridge to further explanation of selected keywords and contain text and graphics to clarify system operation.

        1) If help feature does not have ability to bridge on keywords for more information, provide a complete set of user manuals in an indexed word-processing program, which runs concurrently with operating system software.

    c. Available for Every Menu Item:

        1) Index items for each system menu item.

22. Provide graphic generation software to allow operator ability to add, modify, or delete system graphic displays.

    a. Include libraries of symbols depicting HVAC symbols such as fans, coils, filters, dampers, valves pumps, and electrical symbols.
    b. Use a pointing device in conjunction with a drawing program to allow operator to perform the following:

        1) Define background screens.
        2) Define connecting lines and curves.
        3) Locate, orient, and size descriptive text.
        4) Define and display colors for all elements.
        5) Establish correlation between symbols or text and associated system points or other displays.

D. Project-Specific Graphics: Graphics documentation including, but not limited to, the following:

1. Site plan showing each building, and additional site elements, which are being controlled or monitored by DDC system.
2. Plan for each building floor, including interstitial floors, and each roof level of each building, showing the following:

    a. Room layouts with room identification and name.
    b. Locations and identification of all monitored and controlled HVAC equipment and other equipment being monitored and controlled by DDC system.
    c. Location and identification of each hardware point being controlled or monitored by DDC system.

3. Control schematic for each of following, including a graphic system schematic representation with point identification, set point and dynamic value indication, sequence of operation and control logic diagram.
4. Graphic display for each piece of equipment connected to DDC system through a data communications link. Include dynamic indication of all points associated with equipment.
5. DDC system network riser diagram that shows schematic layout for entire system including all networks and all controllers, gateways operator workstations and other network devices.

E. Customizing Software:

1. Software to modify and tailor DDC system to specific and unique requirements of equipment installed, to programs implemented and to staffing and operational practices planned.
2. Online modification of DDC system configuration, program parameters, and database using menu selection and keyboard entry of data into preformatted display templates.
3. At a minimum, include the following modification capability:

   a. Operator Assignment: Designation of operator passwords, access levels, point segregation, and auto sign-off.
   b. Peripheral Assignment: Assignment of segregation groups and operators to consoles and printers, designation of backup workstations and printers, designation of workstation header points, and enabling and disabling of print-out of operator changes.
   c. System Configuration and Diagnostics; Communications and peripheral port assignments, DDC controller assignments to network, DDC controller enable and disable, assignment of command trace to points, and application programs and initiation of diagnostics.
   d. System Text Addition and Change: English or native language descriptors for points, segregation groups and access levels and action messages for alarms, run time, and trouble condition.
   e. Time and Schedule Change: Time and date set, time and occupancy schedules, exception and holiday schedules, and daylight-savings time schedules.
   f. Point related change capability is to include the following:

      1) System and point enable and disable.
      2) Run-time enable and disable.
      3) Assignment of points to segregation groups, calibration tables, lockout, and run time and to a fixed I/O value.
      4) Assignment of alarm and warning limits.

   g. Application program change capability is to include the following:

      1) Enable and disable of software programs.
      2) Programming changes.
      3) Assignment of comfort limits, global points, time and event initiators, time and event schedules and enable and disable time and event programs.

4. Provide software to allow operator ability to add points, or groups of points, to DDC system and to link them to energy optimization and management programs. Make additions and modifications online programmable using operator workstations, downloaded to other network devices and entered into their databases. After verification of point additions and associated program operation, upload and record database on hard drive and disc for archived record.
5. Include high-level language programming software capability for implementation of custom DDC programs. Include a compiler, linker, and up- and down-load capability.
6. Include a library of DDC algorithms, intrinsic control operators, arithmetic, logic, and relational operators for implementation of control sequences. Also include, at a minimum, the following:

    a. Proportional control (P).
    b. Proportional plus integral (PI).
    c. Proportional plus integral plus derivative (PID).
    d. Adaptive and intelligent self-learning control.

        1) Algorithm monitors loop response to output corrections and adjust loop response characteristics in accordance with time constant changes imposed.
        2) Algorithm operates in a continuous self-learning manner and retains in memory a stored record of system dynamics so that on system shut down and restart, learning process starts from where it left off.

7. Fully implemented intrinsic control operators including sequence, reversing, ratio, time delay, time of day, highest select AO, lowest select AO, analog controlled digital output, analog control AO, and digitally controlled AO.
8. Logic operators such as "And," "Or," "Not," and others that are part of a standard set available with a high-level language.
9. Arithmetic operators such as "Add," "Subtract," "Multiply," "Divide," and others that are part of a standard set available with a high-level language.
10. Relational operators such as "Equal to," "Not Equal to," "Less Than," "Greater Than," and others that are part of a standard set available with a high-level language.

F. Alarm Handling Software:

1. Include alarm handling software to report all alarm conditions monitored and transmitted through DDC controllers and other network devices.
2. Include first in, first out handling of alarms in accordance with alarm priority ranking, with most critical alarms first, and with buffer storage in case of simultaneous and multiple alarms.
3. Make alarm handling active at all times to ensure that alarms are processed even if an operator is not currently signed on to DDC system.
4. Alarms display is to include the following:

    a. Indication of alarm condition such as "Abnormal Off," "Hi Alarm," and "Low Alarm."

b. "Analog Value" or "Status" group and point identification with native language point descriptor such as "Space Temperature, Building 110, 2nd Floor, Room 212."
c. Discrete per point alarm action message, such as "Call Maintenance Dept. Ext-5561."
d. Include extended message capability to allow assignment and printing of extended action messages. Capability is to be operator programmable and assignable on a per point basis.

5. Direct alarms to appropriate operator workstations, printers, and individual operators by privilege level and segregation assignments.
6. Send email alarm messages to designated operators.
7. Send email, page, text, and voice messages to designated operators for critical alarms.
8. Categorize and process alarms by class.

a. Class 1:

1) Associated with fire, security, and other extremely critical equipment monitoring functions; have alarm, trouble, return to normal, and acknowledge conditions printed and displayed.
2) Unacknowledged alarms to be placed in unacknowledged alarm buffer.
3) All conditions make an audible alarm sound and require individual acknowledgment to silence audible sound.

b. Class 2:

1) Critical, but not life-safety related, and processed same as Class 1 alarms, except do not require individual acknowledgment.
2) Acknowledgement may be through a multiple alarm acknowledgment.

c. Class 3:

1) General alarms; printed, displayed, and placed in unacknowledged alarm buffer queues.
2) Configure so each new alarm received makes an audible alarm sound that are silenced by "acknowledging" alarm or by pressing a "silence" key.
3) Make acknowledgement of queued alarms either on an individual basis or through a multiple alarm acknowledgement.
4) Print alarms returning to normal condition without an audible alarm sound or require acknowledgment.

d. Class 4:

1) Routine maintenance or other types of warning alarms.
2) Alarms to be printed only, with no display, no audible sound and no acknowledgment required.

9. Include an unacknowledged alarm indicator on display to alert operator that there are unacknowledged alarms in system. Operator able to acknowledge alarms on an individual basis or through a multiple alarm acknowledge key, depending on alarm class.
10. To ensure that no alarm records are lost, make it possible to assign a backup printer to accept alarms in case of failure of primary printer.

G. Reports and Logs:

1. Include reporting software package that allows operator to select, modify, or create reports using DDC system I/O point data available.
2. Setup each report so data content, format, interval, and date are operator definable.
3. Sample and store report data on DDC controller, within storage limits of DDC controller, and then uploaded to archive on workstation for historical reporting.
4. Make it possible for operators to obtain real-time logs of all I/O points by type or status, such as alarm, point lockout, or normal.
5. Store reports and logs on workstation hard drives in a format that is readily accessible by other standard software applications, including spreadsheets and word processing.
6. Make reports and logs readily printable and set to be print either on operator command or at a specific time each day.

H. Standard Reports: Provide standard DDC system reports with operator ability to customize reports later.

1. All I/O: With current status and values.
2. Alarm: All current alarms, except those in alarm lockout.
3. Disabled I/O: All I/O points that are disabled.
4. Alarm Lockout I/O: All I/O points in alarm lockout, whether manual or automatic.
5. Alarm Lockout I/O in Alarm: All I/O in alarm lockout that are currently in alarm.
6. Logs:

    a. Alarm history.
    b. System messages.
    c. System events.
    d. Trends.

I. Custom Reports: Operator able to easily define and prepare any system data into a daily, weekly, monthly, annual, or other historical report. Reports to include a title with time and date stamp.

J. HVAC Equipment Reports: Prepare Project-specific reports.

K. Utility Reports: Prepare Project-specific reports.

1. Electric Report:

    a. Include weekly report showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.

b. Include monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each meter.
c. Include annual report showing monthly electrical consumption and peak electrical demand with time and date stamp for each meter.
d. For each weekly, monthly, and annual report, include sum total of submeters combined by load type, such as lighting, receptacles, and HVAC equipment showing daily electrical consumption and peak electrical demand.
e. For each weekly, monthly, and annual report, include sum total of all submeters in building showing electrical consumption and peak electrical demand.

2. Natural Gas Report:

a. Include weekly, monthly, and annual report showing daily natural gas consumption and peak natural gas demand with time and date stamp for each meter.
b. For each weekly, monthly, and annual report, include sum total of submeters combined by load type, such as rooftop units and service water heaters showing daily natural gas consumption and peak natural gas demand.
c. For each weekly, monthly, and annual report, include sum total of all submeters in building showing natural gas consumption and peak natural gas demand.

3. Service Water Report:

a. Include weekly, monthly, and annual report showing daily service water consumption and peak service water demand with time and date stamp for each meter.
b. For each weekly, monthly, and annual report, include sum total of submeters combined by load type, such as cooling tower makeup and irrigation showing daily service water consumption and peak service water demand.
c. For each weekly, monthly. and annual report, include sum total of all submeters in building showing service water consumption and peak service water demand.

L. Energy Reports: Prepare Project-specific daily, weekly, monthly, and annual energy reports.

1. Prepare report for each purchased energy utility, indicating the following:

a. Time being reported with beginning and end date, and time indicated.
b. Consumption in units of measure commonly used to report specific utility consumption over time.
c. Gross area served by utility.
d. Consumption per unit area served using utility-specific unit of measure.
e. Cost per utility unit.
f. Utility cost per unit area.

g. Convert all utilities to a common energy consumption unit of measure and report for each utility.
h. Consumption per unit area using common unit of measure.

2. Prepare purchased energy utility report for each submetered area that indicates the following:

a. Time being reported with beginning and end date, and time indicated.
b. Gross area served.
c. Energy consumption by energy utility type.
d. Energy consumption per unit area by energy utility type.
e. Total energy consumption of all utilities in common units of measure.
f. Total energy consumption of all utilities in common units of measure per unit area.
g. Unit energy cost by energy utility type.
h. Energy cost by energy utility type.
i. Energy cost per unit area by energy utility type.
j. Total cost of all energy utilities.
k. Total cost of all energy utilities per unit area.

3. Prepare Project total purchased energy utility report that combines all purchased energy utilities and all areas served. Project total energy report is to indicate the following:

a. Time being reported with beginning and end date, and time indicated.
b. Gross area served.
c. Energy consumption by energy utility type.
d. Energy consumption per unit area by energy utility type.
e. Total energy consumption of all utilities in common units of measure.
f. Total energy consumption of all utilities in common units of measure per unit area.
g. Unit energy cost by energy utility type.
h. Energy cost by energy utility type.
i. Energy cost per unit area by energy utility type.
j. Total cost of all energy utilities.
k. Total cost of all energy utilities per unit area.

M. Standard Trends:

1. Trend all I/O point present values, set points, and other parameters indicated for trending.
2. Associate trends into groups, and setup a trend report for each group.
3. Store trends within DDC controller and uploaded to hard drives automatically on reaching 75 percent of DDC controller buffer limit, or by operator request, or by archiving time schedule.
4. Preset trend intervals for each I/O point after review with Owner.
5. Make trend intervals operator selectable from 10 seconds up to 60 minutes. Make minimum number of consecutive trend values stored at one time 100 per variable.
6. When drive storage memory is full, overwrite oldest data with most recent data.

7. Make archived and real-time trend data available for viewing numerically and graphically by operators.

N. Custom Trends: Operator-definable custom trend log for any I/O point in DDC system.

1. Include each trend with interval, start time, and stop time.
2. Sample and store data on DDC controller, within reaching 75 percent storage limits of DDC controller, and then uploaded to archive on server hard drives.
3. Make data retrievable for use in spreadsheets and standard database programs.

O. Programming Software:

1. Include programming software to execute sequences of operation indicated.
2. Include programming routines in simple and easy to follow logic with detailed text comments describing what the logic does and how it corresponds to sequence of operation.
3. Programming software is to be as follows:

a. Graphic Based: Use a library of function blocks made from preprogrammed code designed for DDC control systems.

1) Assemble function blocks with interconnection lines that represent to control sequence in a flowchart.
2) Make programming tools viewable in real time to show present values and logical results of each function block.

4. Include means for detecting programming errors and testing software control strategies with a simulation tool before implementing in actual control. Simulation tool may be inherent with programming software or as a separate product.

P. Database Management Software:

1. Where a separate SQL database is used for information storage, include database management software that separates database monitoring and managing functions by supporting multiple separate windows.
2. Secure database access using standard SQL authentication including ability to access data for use outside of DDC system applications.
3. Include database management function summarizing information on trend, alarm, event, and audit for the following database management actions:

a. Backup.
b. Purge.
c. Restore.

4. Database management software supporting the following:

a. Statistics: Display database server information and trend, alarm, event, and audit information on database.

b. Maintenance: Include method of purging records from trend, alarm, event, and audit databases by supporting separate screens for creating a backup before purging, selecting database, and allowing for retention of a selected number of day's data.
c. Backup: Include means to create a database backup file and select a storage location.
d. Restore: Include a restricted means of restoring a database by requiring operator to have proper security level.

5. Information of current database activity, including the following:

a. Ready.
b. Purging record from a database.
c. Action failed.
d. Refreshing statistics.
e. Restoring database.
f. Shrinking a database.
g. Backing up a database.
h. Resetting Internet information services.
i. Starting network device manager.
j. Shutting down the network device manager.
k. Action successful.

6. Database management software monitoring functions is to continuously read database information once operator has logged on.
7. Include operator notification through on-screen pop-up display and email message when database value has exceeded a warning or alarm limit.
8. Monitoring settings window with the following Sections:

a. Allow operator to set and review scan intervals and start times.
b. Email: Allow operator to create and review email and phone text messages to be delivered when a warning or an alarm is generated.
c. Warning: Allow operator to define warning limit parameters, set reminder frequency, and link email message.
d. Alarm: Allow operator to define alarm limit parameters, set reminder frequency, and link email message.
e. Database Login: Protect system from unauthorized database manipulation by creating a read access and a write access for each of trend, alarm, event, and audit databases as well as operator proper security access to restore a database.

9. Monitoring settings taskbar with following informational icons:

a. Normal: Indicates by color and size, or other easily identifiable means, that all databases are within their limits.
b. Warning: Indicates by color and size, or other easily identifiable means, that one or more databases have exceeded their warning limit.
c. Alarm: Indicates by color and size, or other easily identifiable means, that one or more databases have exceeded their alarm limit.

2.11 ASHRAE 135 GATEWAYS

A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable.

B. Include gateways to connect BACnet to legacy systems where indicated, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment.

C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.

D. Gateway Minimum Requirements:

1. Read and view all readable object properties on non-BACnet network to BACnet network, and vice versa, where applicable.
2. Write to all writable object properties on non-BACnet network from BACnet network, and vice versa, where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet, and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs in accordance with ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
6. Backup programming and parameters on CD media with ability to modify, download, backup, and restore gateway configuration.

2.12 ASHRAE 135 PROTOCOL ANALYZER

A. Analyzer and required cables and fittings for connection to ASHRAE 135 network.

B. Include the following minimum capabilities:

1. Capture and store to a file data traffic on all network levels.
2. Measure bandwidth usage.
3. Filtering options with ability to ignore select traffic.

2.13 DDC CONTROLLERS

A. DDC system consisting of a combination of network controllers, programmable application controllers, and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers to perform monitoring, control, energy optimization, and other requirements indicated.

C. DDC controllers are to use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller is capable of full and complete operation as a completely independent unit and as a part of DDC system wide distributed network.

E. Environment Requirements:

1. Controller hardware suitable for anticipated ambient conditions.
2. Controllers located in conditioned space rated for operation at 32 to 120 deg F.
3. Controllers located outdoors rated for operation at 40 to 150 deg F.

F. Power and Noise Immunity:

1. Operate controller at 90 to 110 percent of nominal voltage rating and perform an orderly shutdown below 80 percent of nominal voltage.
2. Protect against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

G. DDC Controller Spare Processing Capacity:

1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:

a. Network Controllers: 50 percent.

2. Memory for DDC controller's operating system and database are to include the following:

a. Monitoring and control.
b. Energy management, operation, and optimization applications.
c. Alarm management.
d. Historical trend data of all connected I/O points.
e. Maintenance applications.
f. Operator interfaces.
g. Monitoring of manual overrides.

H. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:

1. Network Controllers:

a. 10 percent of each AI, AO, BI, and BO point connected to controller.
b. Minimum Spare I/O Points per Controller:

1) AIs: Two.
2) AOs: Two.
3) BIs: Three.
4) BOs: Three.
5) Option to provide universal I/O to meet spare requirements.

2. Programmable Application Controllers:

    a. 10 percent of each AI, AO, BI, and BO point connected to controller.
    b. Minimum Spare I/O Points per Controller:

        1) AIs: Two.
        2) AOs: Two.
        3) BIs: Three.
        4) BOs: Three.
        5) Option to provide universal I/O to meet spare requirements.

3. Application-Specific Controllers:

    a. 10 percent of each AI, AO, BI, and BO point connected to controller.
    b. Minimum Spare I/O Points per Controller:

        1) AIs: One.
        2) AOs: One.
        3) BIs: One.
        4) BOs: One.
        5) Option to provide universal I/O to meet spare requirements.

I. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

J. General Requirements for CTA-709.1-D DDC Controllers:

1. Distinguishable and accessible switch, button, or pin, when pressed is to broadcast its 48-bit Node ID and Program ID over network.
2. TP/FT-10 transceiver in accordance with CTA-709.3 and connections for TP/FT-10 control network wiring.
3. TP/XF-1250 transceiver in accordance with CTA-709.3 and connections for TP/XF-1250 control network wiring.
4. Communicate using CTA-709.1-D protocol.
5. Controllers configured into subnets, as required, to comply with performance requirements indicated.
6. Network communication through LNS network management and database standard for CTA-709.1-D network devices.
7. Locally powered, not powered through network connection.
8. Functionality required to support applications indicated including, but not limited to, the following:

a. I/Os indicated and as required to support sequence of operation and application in which it is used. SNVTs to have meaningful names identifying the value represented by SNVT. Unless SNVT of an appropriate engineering type is unavailable, all network variables to be of SNVT with engineering units appropriate to value the variable represents.

K. I/O Point Interface:

1. Connect hardwired I/O points to network, programmable application, and application-specific controllers.
2. Protect I/O points so shorting of point to itself, to another point, or to ground will not damage controller.
3. Protect I/O points from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:

   a. Include monitoring of low-voltage (0 to 10 V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
   b. Compatible with, and field configurable to, sensor and transmitters installed.
   c. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
   d. Signal conditioning including transient rejection for each AI.
   e. Capable of being individually calibrated for zero and span.
   f. Incorporate common-mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.
   g. External conversion resistors are not permitted.

5. AOs:

   a. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
   b. Output signals range of 4 to 20 mA dc or 0 to 10 V dc as required to include proper control of output device.
   c. Capable of being individually calibrated for zero and span.
   d. Drift is to be not greater than 0.4 percent of range per year.
   e. External conversion resistors are not permitted.

6. BIs:

   a. Accept contact closures and ignore transients of less than 5 ms duration.
   b. Isolate and protect against an applied steady-state voltage of up to 180 V ac peak.
   c. Include a wetting current of at least 12 mA to be compatible with commonly available control devices and protected against effects of contact bounce and noise.
   d. Sense "dry contact" closure without external power (other than that provided by controller) being applied.

e. Pulse accumulation input points complying with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Include buffer to totalize pulses. Pulse accumulator is to accept rates of at least 20 pulses per second. Reset the totalized value to zero on operator's command.

7. BOs:

a. Include relay contact closures or triac outputs for momentary and maintained operation of output devices.

1) Relay contact closures to have a minimum duration of 0.1 second and at least 180 V of isolation.
2) Include electromagnetic interference suppression on all output lines to limit transients to non-damaging levels.
3) Minimum contact rating to be 1 A at 24 V ac.
4) Triac outputs to have at least 180 V of isolation and minimum contact rating of 1 A at 24 V ac.

b. Include BOs with two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
c. BOs to be selectable for either normally open or normally closed operation.
d. Include tristate outputs (two coordinated BOs) for control of three-point, floating-type electronic actuators without feedback.
e. Limit use of three-point floating devices to VAV terminal unit control applications, and other applications indicated on Drawings,. Control algorithms to operate actuator to one end of its stroke once every 12 hours for verification of operator tracking.

2.14 NETWORK CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Include enough memory to support its operating system, database, and programming requirements with spare memory indicated.
4. Share data between networked controllers and other network devices.
5. Operating system of controller to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Include network controllers with a real-time clock.
7. Controller to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller is to assume a predetermined failure mode and generate an alarm notification.
8. Make controllers fully programmable.

B. Communication:

1. Network controller to also perform routing if connected to network of programmable application controllers and application-specific controllers.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation mobile device.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Maintain Basic Input Output System (BIOS) and programming information in event of power loss for at least 72 hours.

2.15 PROGRAMMABLE APPLICATION CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide enough memory to support its operating system, database, and programming requirements with spare memory indicated.
3. Share data between networked controllers and other network devices.
4. Include controller with operating system to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Include controllers that perform scheduling with a real-time clock.
6. Controller is to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller assumes a predetermined failure mode and generates an alarm notification.
7. Fully programmable.

B. Communication:

1. Programmable application controllers are to communicate with other devices on network.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation mobile device.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

3. Maintain BIOS and programming information in event of power loss for at least 72 hours.

2.16 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment or system. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.

1. Capable of standalone operation and continued control functions without being connected to network.
2. Share data between networked controllers and other network devices.

B. Communication: Application-specific controllers are to communicate with other application-specific controllers and devices on network, and to programmable application controllers and network controllers.

C. Operator Interface: Equip controllers with a service communications port for connection to portable operator's workstation mobile device. Connection is to extend to port on space temperature sensor that is connected to controller.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.17 CONTROLLER SOFTWARE

A. General:

1. Software applications are to reside and operate in controllers. Edit applications through operator workstations or mobile devices.
2. Identify I/O points by up to 30-character point name and up to 16-character point descriptor. Use same names throughout, including at operator workstations.
3. Execute control functions within controllers using DDC algorithms.
4. Configure controllers to use stored default values to ensure fail-safe operation. Use default values when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Secure operator access using individual security passwords and user names.
2. Passwords restrict operator to points, applications, and system functions as assigned by system manager.

3. Record operator log-on and log-off attempts.
4. Protect from unauthorized use by automatically logging off after last keystroke. Make the delay time operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule is to consist of the following:

1. Weekly Schedule:

a. Include separate schedules for each day of week.
b. Each schedule should include capability for start, stop, optimal start, optimal stop, and night economizer.
c. Each schedule may consist of up to 10 events.
d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:

a. Include ability for operator to designate any day of the year as an exception schedule.
b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.

3. Holiday Schedules:

a. Include capability for operator to define up to 99 special or holiday schedules.
b. Place schedules on scheduling calendar with ability to repeated each year.
c. Operator able to define length of each holiday period.

D. System Coordination:

1. Include standard application for proper coordination of equipment.
2. Include operator with a method of grouping together equipment based on function and location.
3. Include groups that may be for use in scheduling and other applications.

E. Binary Alarms:

1. Set each binary point to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:

1. Provide each analog object with both high and low alarm limits.
2. Include capability to automatically and manually disable alarming.

G. Alarm Reporting:

1. Include ability for operators to determine action to be taken in event of an alarm.

2. Route alarms to appropriate operator workstations based on time and other conditions.
3. Include ability for alarms to start programs, print, be logged in event logs, generate custom messages, and display graphics.

H. Remote Communication:

1. Include ability for system to notify operators by phone message, text message, and email in event of an alarm.

I. Electric Power Demand Limiting:

1. Monitor building or other operator-defined electric power consumption from signals connected to electric power meter or from a watt transducer or current transformer.
2. Predict probable power demand such that action can be taken to prevent exceeding demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
3. Accomplish demand reduction by the following means:

    a. Reset air-handling-unit supply temperature set points.
    b. Reset space temperature set points.
    c. De-energize equipment based on priority.

4. Base demand-limiting parameters, frequency of calculations, time intervals, and other relevant variables on the means by which electric power service provider computes demand charges.
5. Include demand-limiting prediction and control for any individual meter monitored by system or for total of any combination of meters.
6. Include means operator to make the following changes online:

    a. Addition and deletion of loads controlled.
    b. Changes in demand intervals.
    c. Changes in demand limit for meter(s).
    d. Maximum shutoff time for equipment.
    e. Minimum shutoff time for equipment.
    f. Select rotational or sequential shedding and restoring.
    g. Shed and restore priority.

7. Include the following information and reports, to be available on an hourly, daily, weekly, monthly, and annual basis:

    a. Total electric consumption.
    b. Peak demand.
    c. Date and time of peak demand.
    d. Daily peak demand.

J. Maintenance Management: Monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.

K. Sequencing: Include application software based on sequences of operation indicated to properly sequence applicable HVAC equipment.

L. Control Loops:

1. Support any of the following control loops, as applicable to control required:

a. Two-position (on/off, open/close, slow/fast) control.
b. Proportional control.
c. Proportional plus integral (PI) control.
d. Proportional plus integral plus derivative (PID) control.

1) Include PID algorithms with direct or reverse action and anti-windup.
2) Algorithm to calculate a time-varying analog value used to position an output or stage a series of outputs.
3) Make controlled variable, set point, and PID gains operator-selectable.

e. Adaptive (automatic tuning).

M. Staggered Start: Prevent all controlled equipment from simultaneously restarting after a power outage. Make the order which equipment (or groups of equipment) is started, along with the time delay between starts, operator-selectable.

N. Energy Calculations:

1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.
2. Include algorithm that calculates a sliding-window average (rolling average). Make algorithm flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
3. Include algorithm that calculates a fixed-window average. Use a digital input signal to define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.

O. Anti-Short Cycling:

1. Protect BO points from short cycling.
2. Feature to allow minimum on-time and off-time to be selected.

P. On and Off Control with Differential:

1. Include algorithm that allows BO to be cycled based on a controlled variable and set point.
2. Use direct- or reverse-acting algorithm and incorporate an adjustable differential.

Q. Run-Time Totalization:

1. Include software to totalize run-times for all BI and BO points.
2. Assign a high run-time alarm, if required, by operator.

2.18 ENCLOSURES

A. General:

1. House each controller and associated control accessories in single enclosure. Enclosure is to serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies, and transformers.
2. Do not house more than one controller in single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Individual, wall-mounted, single-door enclosures maximum of 36 inches wide and 60 inches high.
5. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
6. Supply each enclosure with complete set of as-built schematics, tubing, and wiring diagrams and product literature located in pocket on inside of door.

B. Internal Arrangement:

1. Arrange internal layout of enclosure to group and protectelectric, and electronic components associated with controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling, and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 10 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install maximum of two wires on each side of terminal.
9. Include enclosure field electric power supply with toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with line-voltage nominal 20 A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with 5 A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).
12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). Nameplates are to have at least 1/4-inch-high lettering.
13. Route tubing cable and wire located inside enclosure within a raceway with continuous removable cover.
14. Label each end of cable, wire, and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 15 percent spare area on face of panel.

C. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.

2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction, and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

D. Wall-Mounted, NEMA 250, Type 1:

1. NRTL listed in accordance with UL 50 or UL 50E.
2. Construct enclosure of steel, not less than the following:

    a. Enclosure Size Less Than 24 Inches: 0.053 inch thick.
    b. Enclosure Size 24 Inches and Larger: 0.067 inch thick.

3. Finish enclosure inside and out with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior Color: Gray.
    b. Interior Color: Gray.

4. Hinged door full size of front face of enclosure and supported using the following:

    a. Enclosures Sizes Less Than 36 Inches Tall: Multiple butt hinges.
    b. Enclosures Sizes 36 Inches Tall and Larger: Continuous piano hinges.

5. Removable internal panel with gray polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Size Less Than 24 Inches: Solid steel, 0.053 inch thick.
    b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch thick.

6. Internal panel mounting hardware, grounding hardware, and sealing washers.
7. Grounding stud on enclosure body.
8. Thermoplastic pocket on inside of door for record Drawings and Product Data.

E. Wall-Mounted, NEMA 250, Types 4 and 12:

1. NRTL listed in accordance with UL 508A.
2. Seam and joints are continuously welded and ground smooth.

3. Where recessed enclosures are indicated, include enclosures with face flange for flush mounting.
4. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
5. Single-door enclosure sizes up to 60 inches tall by 36 inches wide.
6. Double-door enclosure sizes up to 36 inches tall by 60 inches wide.
7. Construct enclosure of steel, not less than the following:

    a. Size Less Than 24 Inches: 0.053 inch thick.
    b. Size 24 Inches and Larger: 0.067 inch thick.

8. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior Color: Gray.
    b. Interior Color: Gray.

9. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.

    a. Sizes through 24 Inches Tall: Two hinges.
    b. Sizes between 24 Inches through 48 Inches Tall: Three hinges.
    c. Sizes Larger Than 48 Inches Tall: Four hinges.

10. Double-door enclosures with overlapping door design to include unobstructed full-width access.

    a. Single-door enclosures 48 inches and taller, and all double-door enclosures, with three-point (top, middle and bottom) latch system.

11. Removable internal panel with gray polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Size Less Than 24 Inches: Solid steel, 0.053 inch thick.
    b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch thick.

12. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
13. Grounding stud on enclosure body.
14. Thermoplastic pocket on inside of door for record Drawings and Product Data.

F. Wall-Mounted, NEMA 250, Type 4X-SS:

1. NRTL listed in accordance with UL 508A.
2. Seams and joints are continuously welded and ground smooth.
3. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
4. Construct enclosure of Type 304 stainless steel, not less than the following:

    a. Size Less Than 24 Inches: 0.053 inch thick.
    b. Size 24 Inches and Larger: 0.067 inch thick.

5. Outside body and door of enclosure with brushed No. 4 finish.
6. Corner-formed door, full size of enclosure face, supported using continuous piano hinge full length of door.
7. Removable internal panel of 0.093-inch stainless steel.
8. Internal panel mounting studs and hardware, grounding hardware, and sealing washers.
9. Install corrosion-resistant polyester vent drain in a stainless steel sleeve at bottom of enclosure.
10. Include enclosure with stainless steel mounting brackets.

2.19 RELAYS

A. General-Purpose Relays:

1. NRTL listed.
2. Heavy-duty, electromechanical type; rated for at least 10 A at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with 8-pin octal or multiblade plug for DPDT relays and 11-pin octal or multiblade plug for three-pole double-throw relays.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in apolycarbonate dust-tight cover.
7. Include LED indication and push-to-test button to test manual operation of relay without power on coil.
8. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 2 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

9. Equip relays with coil transient suppression to limit transients to non-damaging levels.
10. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
11. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

B. Multifunction Time-Delay Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 240 V ac and 60 Hz.
3. Relay with up to 4 programmable functions to provide on/off delay, interval, and recycle timing functions.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.

6. Enclose relay in a dust-tight cover.
7. Include knob and dial scale for alternative digital interface for setting delay time.
8. Visual Status Indication: Power "On" and Output "On" status.
9. Performance:

    a. Mechanical Life: At least 10 Insert number million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
    d. Repeatability: Within 2 percent.
    e. Recycle Time: 45 ms.
    f. Minimum Pulse-Width Control: 50 ms.
    g. Power Consumption: 5 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

10. Equip relays with transient suppression to limit transients to non-damaging levels.
11. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
12. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

C. Latching Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in apolycarbonate dust-tight cover.
7. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 2 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

D. Current Sensing Relays:

1. NRTL listed.
2. Monitors ac current.

3. Independent adjustable controls for pickup and dropout current.
4. Energized when supply voltage is present and current is above pickup setting.
5. De-energizes when monitored current is below dropout current.
6. Dropout current is adjustable from 50 to 95 percent of pickup current.
7. Visual indication of contact status.
8. Include current transformer, if required for application.
9. House current sensing relay and current transformer if required in its own enclosure. Use NEMA 250, Type 1 enclosure for indoors applications and NEMA 250, Type 4 or Type 4X for outdoor applications.

E. Combination On-Off Status Sensor and On-Off Control Relays:

1. Description:

   a. On-off control and on-off status indication in a single device.
   b. LED status indication of activated relay and current trigger.
   c. Closed-Open-Auto override switch located on the load side of relay.

2. Performance:

   a. Ambient Temperature: Minus 30 to 140 deg F.
   b. Voltage Rating: Single-phase loads rated for 300 V ac. Three-phase loads rated for 600 V ac.

3. Status Indication:

   a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
   b. Current Sensor Range: As required by application.
   c. Current Set Point: Fixed or adjustable, as required by application.
   d. Current Sensor Output:

      1) Solid-state, SPDT contact rated for 30 V ac and dc and for 0.4 A.
      2) Solid-state, SPDT contact rated for 120 V ac and 1.0 A.
      3) Analog, 0 to 5 or 10 V dc.
      4) Analog, 4 to 20 mA, loop powered.

4. Relay: SPDT, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure for indoor applications; NEMA 250, Type 4 enclosure for outdoor applications.

2.20 ELECTRICAL POWER DEVICES

A. Control Transformers:

1. Sizing Criteria: Size control transformers for total connected load, plus additional 25 percent of connected load for future spare capacity.
2. Transformer Minimum Capacity: 40 VA.
3. Protection: Provide transformers with both primary and secondary fuses. Integral circuit breaker is acceptable in lieu of fuses.

4. Enclosure: House control transformers in NEMA 250 enclosures, type as indicated in "Performance Requirements" Article for application.

B. Power-Line Conditioners:

1. General Power-Line Conditioner Requirements:

   a. Design to ensure maximum reliability, serviceability, and performance.
   b. Overall function of power-line conditioner is to receive raw, polluted electrical power and purify it for use by electronic equipment. Power-line conditioner is to provide isolated, regulated, transient, and noise-free sinusoidal power to loads served.

2. Standards: NRTL listed per UL 1012.
3. Performance:

   a. Single phase, continuous, 100 percent duty rated kVA/kW capacity. Design to supply power for linear or nonlinear, high crest factor, resistive and reactive loads.
   b. Automatically regulate output voltage to within 2 percent or better with input voltage fluctuations of plus 10 to minus 20 percent of nominal when system is loaded 100 percent. Use Variable Range Regulation to obtain improved line voltage regulation when operating under less than full load conditions.

      1) At 75 Percent Load: Output voltage automatically regulated to within 3 percent with input voltage fluctuations of plus 10 to minus 35 percent of nominal.
      2) At 50 Percent Load: Output voltage automatically regulated to within 3 percent with input voltage fluctuations of plus 10 to minus 40 percent of nominal.
      3) At 25 Percent Load: Output voltage automatically regulated to within 3 percent with input voltage fluctuations of plus 10 to minus 45 percent of nominal.

   c. With input voltage distortion of up to 40 percent, limit the output voltage sine wave to maximum harmonic content of 5 percent.
   d. Automatically regulate output voltage to within 2.5 percent when load (resistive) changes from zero to 100 to zero percent.
   e. Output voltage returns to 95 percent of nominal level within two cycles and to 100 percent within three cycles when output is taken from no load to full-resistive load, or vice versa. Recovery from partial resistive load changes is corrected in a shorter period.
   f. K Factor: 30, designed to operate with nonlinear, non-sinusoidal, high crest factor loads without overheating.
   g. Input power factor within 0.95 approaching unity with load power factor as poor as 0.6.
   h. Attenuate load-generated odd current harmonics 23 dB at the input.
   i. Electrically isolate the primary from the secondary. Meet isolation criteria as defined in NFPA 70, Article 250-5D.

j. Lighting and Surge Protection: Compares to UL 1449 rating of 330 V when subjected to Category B3 (6000 V/3000 A) combination waveform as established by IEEE C62.41.1 and IEEE C62.41.2.
k. Common-mode noise attenuation of 140 dB.
l. Transverse-mode noise attenuation of 120 dB.
m. With loss of input power for up to 16.6 ms, output sine wave remains at usable ac voltage levels.
n. Reliability of 200,000 hours' MTBF.
o. At full load, when measured at 1 m distance, audible noise is not to exceed 54 dB.
p. Approximately 92 percent efficient at full load.

4. Transformer Construction:

a. Ferroresonant, dry type, convection cooled, 600 V class. Transformer windings of Class H (220 deg C) insulated copper.
b. Use Class H installation system throughout with operating temperatures not to exceed 150 deg C over a 40 deg C ambient temperature.
c. Configure transformer primary for multi-input voltage. Include input terminals for source conductors and ground.
d. Manufacture transformer core using M-6 grade, grain-oriented, stress-relieved transformer steel.
e. Configure transformer secondary in 240/120 V split with 208 V tap or straight 120 V, depending on power output size.
f. Electrically isolate the transformer secondary windings from primary windings. Bond neutral conductor to cabinet enclosure and output neutral terminal.
g. Include interface terminals for output power hot, neutral, and ground conductors.
h. Label leads, wires, and terminals to correspond with circuit wiring diagram.
i. Vacuum impregnate transformer with epoxy resin.

5. Cabinet Construction:

a. Design for panel or floor mounting.
b. NEMA 250, Type 1 or Type 2 enclosure for indoor applications. NEMA 250, Type 3R for outdoor applications.
c. Manufacture the cabinet from heavy gauge steel complying with UL 50 or UL 508A.
d. Include textured baked-on paint finish.

C. DC Power Supplies:

1. Description: Linear or switched, regulated power supplies with ac input to one or multiple dc output(s).

a. Include both line and load regulation to ensure stable output.
b. To protect both power supply and load, include power supply with an automatic current limiting circuit.

2. Features:

a. Connection: Plug-in style suitable for mating with standard 8-pin octal socket. Include power supply with mating mounting socket.
b. Housing: Enclose circuitry in a housing.
c. Local Adjustment: Include screw adjustment on exterior of housing for dc voltage output.
d. Mounting: DIN rail.
e. Visual status indicator.

3. Performance:

a. Input Voltage: Nominally 120 V ac, 60 Hz.
b. Output Voltage: Nominally 24 V dc with plus or minus 1 V dc adjustment.
c. Output Current: Minimum 100 mA.
d. Load Regulation: Within 0.1 percent.
e. Line Regulation: Within 0.05 percent.
f. Stability: Within 0.1 percent of rated volts after warmup period.
g. Ripple: 1 mV rms.

2.21 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.

1. Wire Size: Minimum 18 AWG.
2. Conductors: 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
3. Conductor Insulation: 600 V, Type THWN or Type THHN, and 90 deg C in accordance with UL 83.
4. Conductor Insulation Colors: Black (hot), white (neutral), and green (ground).
5. Furnish on spools.

B. Single, Twisted-Shielded, Instrumentation Cable above 24 V:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor Insulation: Type THHN/THWN or Type TFN rating.
4. Conductor Insulation Colors:

a. Twisted Pair: Black and white.
b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 600 V, 90 deg C rating, and Type TC cable.
7. Furnish on spools.

C. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.

3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Conductor Insulation Colors:

    a. Twisted Pair: Black and white.
    b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
7. Furnish on spools.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Comply with following requirements for balanced twisted pair cable described in Section 260523 "Control-Voltage Electrical Power Cables."

    a. Plenum rated.
    b. Unique color that is different from other cables used on Project.

2.22 RACEWAYS

A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.

B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for raceways for balanced twisted pair cables and optical fiber cables.

2.23 ACCESSORIES

A. Instrument Enclosures:

1. Application: Include instrument enclosure for secondary protection to comply with requirements indicated in "Performance Requirements" Article.
2. Certification: NRTL listed and labeled to UL 50 or UL 508A as applicable.
3. Subpanel:

    a. Size enclosure with least 25 percent spare area on subpanel.
    b. Mount instrument(s) within enclosure on internal subpanel(s).

4. Identification: Include on face of enclosure an engraved, laminated phenolic nameplate for each instrument installed within enclosure.
5. Raceways: For enclosures housing multiple instruments, route tubing, cable, and wiring within enclosure in a raceway having continuous removable cover.
6. Access: Provide enclosures larger than 12 inches with hinged full-size face cover.

2.24 IDENTIFICATION

A. Instrument Air Pipe and Tubing:

1. Engraved tag bearing the following information:

a. Service (Example): "Instrument Air."
b. Pressure Range (Example): 0 to 30 psig.

2. Letter size minimum of 0.25 inch high.
3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded blue with contrasting white center exposed by engraving through outer layer.
4. Include tag with brass grommet, chain, and S-hook.

B. Control Equipment, Instruments, and Control Devices:

1. Self-adhesive label bearing unique identification.

a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Letter size as follows:

a. DDC Controllers: Minimum of 0.5 inch high.
b. Gateways: Minimum of 0.5 inch high.
c. Repeaters: Minimum of 0.5 inch high.
d. Enclosures: Minimum of 0.5 inch high.
e. Electrical Power Devices: Minimum of 0.25 inch high.
f. Accessories: Minimum of 0.25 inch high.
g. Instruments: Minimum of 0.25 inch high.
h. Control Damper and Valve Actuators: Minimum of 0.25 inch high.

3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded black with contrasting white center exposed by engraving through outer layer.
4. Fastened with drive pins.
5. Instruments, control devices, and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

C. Raceway and Boxes:

1. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Paint cover plates on junction boxes and conduit same color as tape banding for conduits. After painting, label cover plate "HVAC Controls".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREINSTALLATION INTEGRATION TESTING

A. Perform the following pretesting of other systems and equipment integration with DDC system before field installation:

1. Test all communications in a controlled environment to ensure connectivity.
2. Load software and demonstrate functional compliance with each control sequence of operation indicated.
3. Using simulation, demonstrate compliance with sequences of operation and other requirements indicated including, but not limited to, the following:

a. HVAC equipment controlled through DDC system, such as packaged rooftop units and exhaust fans.
b. Equipment faults and system recovery with fault annunciation.
c. Analog and Boolean value alarming and annunciation.

4. Develop a method for testing interfaces before deployment.
5. Submit documentation supporting compliance upon request.

3.3 DDC SYSTEM INTERFACE WITH EXISTING SYSTEMS

A. Interface with Existing Systems:

1. Integration of Existing Control System into DDC System:

a. Satisfy existing control system performance requirements when monitoring and controlling existing control system through DDC system.
b. Operator to upload, download, monitor, alarm, report, trend, control, and program every I/O point in existing system from DDC system using operator workstations and software provided. Combined systems to share one database.
c. Make interface of existing control system I/O points into DDC system transparent to operators. Make all operational capabilities identical regardless of whether I/O already exists, or I/O is being installed.

2. Engage Owner's control system integrator to provide the following services:

a. Enterprise system expansion and development of graphics, logs, reports, trends, and other operational capabilities of enterprise system for I/O being added to DDC control system for use by enterprise system operators.
b. Limited assistance during commissioning to extent of DDC system integration with existing enterprise system.
c. Prepare on-site demonstration mockup of integration of DDC system to be installed with existing system before installing DDC system.

3. Attend meetings with control system integrator to integrate DDC system.

3.4 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. Control dampers, which are specified in Section 230923.12 "Control Dampers."
2. Airflow sensors and switches, which are specified in Section 230923.14 "Flow Instruments."
3. Pressure sensors, which are specified in Section 230923.23 "Pressure Instruments."

C. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. Control valves, which are specified in Section 230923.11 "Control Valves."
2. Pipe-mounted flow meters, which are specified in Section 230923.14 "Flow Instruments."
3. Pipe-mounted sensors, switches, and transmitters. Flow meters are specified in Section 230923.14 "Flow Instruments."
4. Tank-mounted sensors, switches, and transmitters. Pressure sensors, switches, and transmitters are specified in Section 230923.23 "Pressure Instruments."

5. Liquid temperature sensors, switches, and transmitters are specified in Section 230923.27 "Temperature Instruments."
6. Pipe- and tank-mounted thermowells. Liquid thermowells are specified in Section 230923.27 "Temperature Instruments."

3.5 CONTROL DEVICES FOR EQUIPMENT MANUFACTURER FACTORY INSTALLATION

A. Deliver the following to air-handling unit manufacturer for factory installation. Include installation instructions to air-handling unit manufacturer and supervise installation for compliance with requirements.

1. Unit-mounted DDC actuators, which are specified in Section 230923.12 "Control Dampers."
2. Unit-mounted airflow sensors, switches, and transmitters, which are specified in Section 230923.14 "Flow Instruments."
3. Unit-mounted pressure sensors, switches, and transmitters, which are specified in Section 230923.23 "Pressure Instruments."
4. Unit-mounted speed sensors, switches, and transmitters, which are specified in Section 230923.24 "Speed Instruments."
5. Unit-mounted temperature sensors, switches, and transmitters. Air-temperature sensors, switches, and transmitters are specified in Section 230923.27 "Temperature Instruments."
6. Relays.

B. Deliver the following to terminal unit manufacturer for factory installation. Include installation instructions to terminal unit manufacturer.

1. Programmable application or application-specific controller.
2. Electric damper actuator. Damper actuators are specified in Section 230923.12 "Control Dampers."
3. Unit-mounted flow and pressure sensors, transmitters, and transducers. Flow sensors, transmitters, and transducers are specified in Section 230923.14 "Flow Instruments." Pressure sensors, switches, and transmitters are specified in Section 230923.23 "Pressure Instruments."
4. Unit-mounted temperature sensors. Air-temperature sensors, switches, and transmitters are specified in Section 230923.27 "Temperature Instruments."
5. Relays.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring, and raceways.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."

G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. Fastening Hardware:

1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

I. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

1. When conduit is in contact with a corrosive airstream and environment, use Type 316 stainless steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment. Comply with requirements for installation of raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
2. Where instruments are located in a corrosive airstream and are not already corrosive resistant from instrument manufacturer, field install products in NEMA 250, Type 4X instrument enclosure constructed of Type 316L stainless steel.

3.7 INSTALLATION OF WORKSTATIONS

A. Portable Workstation Installation:

B. Color Graphics Application:

1. Use system schematics indicated on Drawings as starting point to create graphics.
2. Develop Project-specific library of symbols for representing system equipment and products.
3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
4. Submit sketch of graphic layout with description of all text for each graphic for Owner's and Architect's review before creating graphic using graphics software.
5. Seek Owner input in graphics development once using graphics software.
6. Make final editing on-site with Owner's and Architect's review and feedback.

7. Refine graphics as necessary for Owner acceptance.
8. On receiving Owner acceptance, print a PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.
9. Connect each cabinet to 120 V, single-phase, 60 Hz field power source and install single gang electrical box with NEMA WD 6, Type 20R duplex receptacle and metal cover plate in cabinet. Comply with requirements in Section 262726 "Wiring Devices."
10. Connect each cabinet to Ethernet network and install an Ethernet network port for connection to portable operator workstation Ethernet cable. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

3.8 INSTALLATION OF SERVERS

A. Install number of servers required to suit requirements indicated. Review Project requirements and indicate layout of proposed server location in Shop Drawings.

B. Install software indicated on server(s) and verify that software functions properly.

C. Develop Project-specific graphics, trends, reports, logs, and historical database.

D. Power servers through dedicated UPS unit. Locate UPS adjacent to server. Install rack-mounted UPS units for powering rack-mounted servers and tower UPS units for tower servers.

3.9 INSTALLATION OF GATEWAYS

A. Install gateways if required for DDC system communication interface requirements indicated.

B. Test gateways to verify that communication interface functions properly.

3.10 INSTALLATION OF ROUTERS

A. Install routers if required for DDC system communication interface requirements indicated.

B. Test routers to verify that communication interface functions properly.

3.11 INSTALLATION OF CONTROLLERS

A. Install controllers in enclosures to comply with indicated requirements.

B. Connect controllers to field power supply and to UPS units where indicated.

C. Install controllers with latest version of applicable software and configure to execute requirements indicated.

D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.

E. Installation of Network Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of network controllers to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor.

F. Installation of Programmable Application Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of programmable application controllers to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor, except where dedicated controllers are installed at terminal units.

G. Application-Specific Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of application-specific controllers to satisfy requirements indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in alocation that is easily accessible by operators.

3.12 INSTALLATION OF ENCLOSURES

A. Install the following items in enclosures, to comply with indicated requirements:

1. Gateways.
2. Routers.
3. Controllers.
4. Electrical power devices.
5. UPS units.
6. Relays.
7. Accessories.
8. Instruments.
9. Actuators.

B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use galvanized-steel strut and hardware.
2. For NEMA 250, Type 4 Type 4X Enclosures and Enclosures Located Outdoors: Use stainless steel strut and hardware.
3. Install plastic caps on exposed cut edges of strut.

C. Align top of adjacent enclosures of like size.

D. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireways used for application are to have protection equal to NEMA 250 rating of connected enclosures.

3.13 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade to provide a fully functioning DDC system. Work is to comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.14 INSTALLATION OF IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install unique instrument identification for each instrument connected to DDC controller.

C. Install unique identification for each control damper and valve actuator connected to DDC controller.

D. Where product is installed above accessible tile ceiling, also install matching identification on face of ceiling grid located directly below.

E. Warning Labels and Signs:

1. Permanently attach to equipment that can be automatically started by DDC control system.
2. Locate where highly visible near power service entry points.

3.15 INSTALLATION OF NETWORKS

A. Install balanced twisted paircable when connecting between the following network devices located in same building:

1. Operator workstations.

2. Operator workstations and network controllers.
3. Network controllers.

B. Install balanced twisted pair or copper cable (as required by equipment) when connecting between the following:

1. Gateways.
2. Gateways and network controllers or programmable application controllers.
3. Routers.
4. Routers and network controllers or programmable application controllers.
5. Network controllers and programmable application controllers.
6. Programmable application controllers.
7. Programmable application controllers and application-specific controllers.
8. Application-specific controllers.

C. Install cable in continuous raceway.

1. Where indicated on Drawings, cable trays may be used for copper cable in lieu of conduit.

3.16 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

B. ASHRAE 135 Networks:

1. MAC Address:

a. Assign and document a MAC address unique to its network for every network device.
b. Ethernet Networks: Document MAC address assigned at its creation.
c. MS/TP Networks: Assign from 00 to 64.

2. Network Numbering:

a. Assign unique numbers to each new network.
b. Provide ability for changing network number through device switches or operator interface.
c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.

3. Device Object Identifier Property Number:

a. Assign unique device object identifier property numbers or device instances for each device network.
b. Provide for future modification of device instance number by device switches or operator interface.
c. LAN is to support up to 4,194,302 unique devices.

4. Device Object Name Property Text:

    a. Device object name property field to support 32 minimum printable characters.
    b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.

        1) Example 1: Device object name for device controlling heating water boiler plant at Building 1000 would be "Heating Water System Bldg. 1000."
        2) Example 2: Device object name for VAV terminal unit controller could be "VAV Unit 102."

5. Object Name Property Text for Other Than Device Objects:

    a. Object name property field is to support 32 minimum printable characters.
    b. Assign object name properties with plain-English names descriptive of application.

        1) Example 1: "Zone 1 Temperature."
        2) Example 2 "Fan Start and Stop."

6. Object Identifier Property Number for Other Than Device Objects:

    a. Assign object identifier property numbers according to Drawings indicated.
    b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented, and be unique for like object types within device.

3.17 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

A. Comply with NECA 1.

B. Wire and Cable Installation:

1. Comply with installation requirements in Section 260523 "Control-Voltage Electrical Power Cables."
2. Comply with installation requirements in Section 271313 "Communications Copper Backbone Cabling."
3. Comply with installation requirements in Section 271513 "Communications Copper Horizontal Cabling."
4. Terminate wiring in a junction box.

    a. Clamp cable over jacket in a junction box.
    b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.

5. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.

6. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
7. Use shielded cable to transmitters.
8. Use shielded cable to temperature sensors.
9. Perform continuity and meager testing on wire and cable after installation.

C. Conduit Installation:

1. Comply with Section 260533 "Raceway and Boxes for Electrical Systems" for control-voltage conductors.
2. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling and optical fiber installation.

3.18 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

3.19 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

E. Control Damper Checkout:

1. Verify that control dampers are installed correctly for flow direction.
2. Verify that proper blade alignment, either parallel or opposed, has been provided.
3. Verify that damper frame attachment is properly secured and sealed.
4. Verify that damper actuator and linkage attachment are secure.
5. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
6. Verify that damper blade travel is unobstructed.

F. Control Valve Checkout:

1. Verify that control valves are installed correctly for flow direction.
2. Verify that valve body attachment is properly secured and sealed.
3. Verify that valve actuator and linkage attachment are secure.
4. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
5. Verify that valve ball, disc, or plug travel is unobstructed.

6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace valve if leaks persist.

G. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments, verify the following:

a. Sensing element type and proper material.
b. Length and insertion.

3.20 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION, AND TESTING

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration to comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

1. Use field testing and diagnostic instruments and equipment with an accuracy at least twice the instrument accuracy of instrument to be calibrated. For example, test and calibrate an installed instrument with accuracy of 1 percent using field testing and diagnostic instrument with accuracy of 0.5 percent or better.

F. Calibrate each instrument in accordance with instruction manual supplied by instrument manufacturer.

G. If after calibration the indicated performance cannot be achieved, replace out-of-tolerance instruments.

H. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Controls Components," in the absence of specific requirements, and to supplement requirements indicated.

I. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

J. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

K. Control Dampers:

1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

L. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

M. Meters: Check meters at zero, 50, and 100 percent of Project design values.

N. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

O. Switches: Calibrate switches to make or break contact at set points indicated.

P. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.21 DDC SYSTEM CONTROLLER CHECKOUT

A. Verify power supply.

1. Verify voltage, phase, and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to backup power source.
6. If applicable, verify that power conditioning units are installed.

B. Verify that wire and cabling are properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.22 DDC CONTROLLER I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify that operation is stable and accurate.
4. Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:

    a. Upper quarter of range.
    b. Lower quarter of range.
    c. At midpoint of range.

8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller, and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller, and at field instrument must match.
10. Prepare and submit report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.23 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Pretest Checklist and Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed Pretest Checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Using BACnet protocol analyzer, verify that communications are error free.
10. Each controller's programming is backed up.
11. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
12. All I/O points are programmed into controllers.
13. Testing, adjusting, and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power and loss of signal.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power and loss of signal.
18. Meter, sensor, and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphics are created.
26. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit validation Test Plan including test procedures for performance validation tests.
2. Address all specified functions of DDC system and sequences of operation in Test Plan.

3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include Test Checklist to be used to check and initial that each test has been successfully completed.
6. Submit Test Plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.

    a. Verify analog I/O points at operating value.
    b. Make adjustments to out-of-tolerance I/O points.

        1) Identify I/O points for future reference.
        2) Simulate abnormal conditions to demonstrate proper function of safety devices.
        3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.

2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. 24 hours after initial validation test, do as follows:

    a. Re-check I/O points that required corrections during initial test.
    b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. 24 Hours after second validation test, do as follows:

    a. Re-check I/O points that required corrections during second test.
    b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit report indicating results of testing. For all I/O points that required correction, indicate how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.24 FINAL REVIEW

A. Submit written request to Architect Commissioning Agent Construction Manager when DDC system is ready for final review. State the following:

1. DDC system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.

2. DDC system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Upon receipt of written request for final review, Commissioning Agent and Construction Manager to start review within reasonable period and upon completion issue field report(s) documenting observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in reviewer's field report(s) and submit second written request after all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Compensation for Subsequent Reviews: Should more than two reviews be required, DDC system manufacturer and Installer to compensate entity/entities performing reviews for total costs (labor and expenses) associated with subsequent reviews. Estimated cost of each subsequent review to be submitted and approved by DDC system manufacturer and Installer before review.

E. Prepare and submit closeout submittals and begin procedures indicated in "Extended Operation Test" Article when no deficiencies are reported.

F. Part of DDC system final review shall include demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration to include, but not be limited to, the following:

    a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
    b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 20 I/O points to be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
    c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
    d. Operation of randomly selected dampers and valves in normal-on, normal-off, and failed positions.
    e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
    f. Trends, summaries, logs, and reports set up for Project.

g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, and uploading and downloading of control programs.
i. Software's ability to edit control programs offline.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Network and Programmable Application Controller:

    1) Memory: Programmed data, parameters, trend, and alarm history collected during normal operation are not to be lost during power failure.
    2) Operator Interface: Ability to connect directly to each type of digital controller with portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
    3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
    4) Electric Power: Ability to disconnect any controller safely from its power source.
    5) Wiring Labels: Match control drawings.
    6) Network Communication: Ability to locate controller's location on network and communication architecture matches Shop Drawings.
    7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

r. For Each Operator Workstation:

    1) I/O points lists agree with naming conventions.
    2) Graphics are complete.
    3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set-Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by operator using workstation graphics, or by completing a field in menu with instructional text.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:

    a) Display of network device status.
    b) Display of BACnet object information.
    c) Silencing devices transmitting erroneous data.
    d) Time synchronization.
    e) Remote device re-initialization.
    f) Backup and restore network device programming and master database(s).
    g) Configuration management of routers.

3.25 EXTENDED OPERATION TEST

A. Operate DDC system for operating period of 21 consecutive calendar days following Substantial Completion. Coordinate exact start date of testing with Owner.

B. Provide operator familiar with DDC system installed to man an operator workstation while on-site during eight hours of each normal business day occurring during operating period.

C. During operating period, DDC system to demonstrate correct operation and accuracy of monitored and controlled points as well as operation capabilities of sequences, logs, trends, reports, specialized control algorithms, diagnostics, and other software indicated.

1. Correct defects of hardware and software when they occur.

D. Definition of Failures and Downtime during Operating Period:

1. Failed I/O point constituting downtime is I/O point failing to perform its intended function consistently and a point physically failed due to hardware and software.
2. Downtime is when any I/O point in DDC system is unable to fulfill its required function.
3. Calculate downtime as elapsed time between detected point failure as confirmed by operator, and time point is restored to service.
4. Maximum time interval allowed between DDC system detection of failure occurrence and operator confirmation is to be 0.5 hours.
5. Log downtime in hours to nearest 0.1 hour.
6. Power outages do not count as downtime, but do suspend test hours unless systems are provided with UPS and served through a backup power source.
7. Hardware or software failures caused by power outages do count as downtime.

E. During operating period, log downtime and operational problems are encountered.

1. Identify source of problem.
2. Provide written description of corrective action taken.
3. Record duration of downtime.
4. Maintain log showing the following:

a. Time of occurrence.
b. Description of each occurrence and pertinent written comments for reviewer to understand scope and extent of occurrence.
c. Downtime for each failed I/O point.
d. Running total of downtime and total time of I/O point after each problem has been restored.

5. Make log available to Owner for review at any time.

F. For DDC system to pass extended operation test, total downtime is limited to 2 percent of total point-hours during operating period.

1. If DDC system testing results fail to comply with minimum requirements of passing at end of operating period indicated, extend operating period one consecutive day at a time until DDC system passes requirement.

G. Base evaluation of DDC system passing test on the following calculation:

1. Count downtime on point-hour basis where total number of DDC system point-hours is equal to total number of I/O points in DDC system multiplied by total number of hours during operating period.

2. One point-hour of downtime is one I/O point down for one hour. For example, three I/O points down for five hours is total of 15 point-hours of downtime. Four points down for one-half hour is two point-hours of downtime.
3. Example Calculation: Maximum allowable downtime for 30-day test for DDC system with 1000 total I/O points (combined analog and binary) and passing score of 1 percent downtime is computed by 30 days x 24 h/day x 1000 points x 1 percent equals 7200 point-hours of maximum allowable downtime.

H. Prepare test and inspection reports.

3.26 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.27 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:

    a. Provide not less than 3 days of training total.
    b. Stagger training over multiple training classes to accommodate Owner's requirements. All training to occur before end of warranty period.
    c. Break down total days of training into not more than two separate training classes.
    d. Schedule training so each training class is not less than two consecutive day(s).

C. Training Schedule:

1. Schedule training with Owner 20 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 10 business days of notice in advance of training.

3. Training to occur within normal business hours at mutually agreed on time. Unless otherwise agreed to, training to occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session to be split in half with 15-minute break between sessions. Morning and afternoon sessions to be separated by 60-minute lunch period. Training, including breaks and excluding lunch period, are not to exceed eight hours per day.
4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number, and email address.
2. Provide preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Include preprinted sign-in sheet with training session number, date and time, instructor name, phone number, email address, and brief description of content to be covered during session. List attendees with columns for name, phone number, and email address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an email with attachment of scanned copy (PDF) of circulated sign-in sheet for each session..

E. Training Attendee Headcount:

1. Plan in advance of training for five attendees.
2. Make allowance for Owner to add up to two Insert number attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Attendee Training Manuals:

1. Provide each attendee with color hard copy of all training materials and visual presentations.
2. Organize hard-copy materials in three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes DVD or flash drive with PDF copy of all hard-copy materials.

G. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.
2. Use instructors who have provided not less than five years of instructional training on not less than five past projects with similar DDC system scope and complexity to DDC system installed.

H. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

   a. Daily operators.
   b. Advanced operators.
   c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions to ensure DDC system security.

I. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Include in outline a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session, and synopses for each lesson planned.

J. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables desks or tables, chairs, power, and data connectivity for each attendee.
2. Provide capability to remotely access to Project DDC system for use in training.
3. Provide operator workstation for use by each attendee.

K. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm, and each unique optimization routine.
5. Operating operator workstations, printers, and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports, and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.

14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Running each specified report and log.
16. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
17. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
18. Executing digital and analog commands in graphic mode.
19. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.
20. Demonstrating DDC system performance through trend logs and command tracing.
21. Demonstrating scan, update, and alarm responsiveness.
22. Demonstrating spreadsheet and curve plot software, and its integration with database.
23. Demonstrating on-line user guide, and help function and mail facility.
24. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
25. Demonstrating the following for HVAC systems and equipment controlled by DDC system:

    a. Operation of HVAC equipment in normal-off, normal-on, and failed conditions while observing individual equipment, dampers, and valves for correct position under each condition.
    b. For HVAC equipment with factory-installed software, show that integration into DDC system is able to communicate with DDC controllers or gateways, as applicable.
    c. Using graphed trends, show that sequence of operation is executed in correct manner, and HVAC systems operate properly through complete sequence of operation including seasonal change, occupied and unoccupied modes, warm-up and cool-down cycles, and other modes of operation indicated.
    d. Hardware interlocks and safeties function properly and DDC system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
    e. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
    f. Each control loop responds to set-point adjustment and stabilizes within time period indicated.
    g. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.

L. Training Content for Advanced Operators:

1. Making and changing workstation graphics.
2. Creating, deleting, and modifying alarms including annunciation and routing.
3. Creating, deleting, and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
4. Creating, deleting, and modifying reports.
5. Creating, deleting, and modifying points.

6. Creating, deleting, and modifying programming including ability to edit control programs offline.
7. Creating, deleting, and modifying system graphics and other types of displays.
8. Adding DDC controllers and other network communication devices such as gateways and routers.
9. Adding operator workstations.
10. Performing DDC system checkout and diagnostic procedures.
11. Performing DDC controllers operation and maintenance procedures.
12. Performing operator workstation operation and maintenance procedures.
13. Configuring DDC system hardware including controllers, workstations, communication devices, and I/O points.
14. Maintaining, calibrating, troubleshooting, diagnosing, and repairing hardware.
15. Adjusting, calibrating, and replacing DDC system components.

M. Training Content for System Managers and Administrators:

1. DDC system software maintenance and backups.
2. Uploading, downloading, and offline archiving of all DDC system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.
7. Operator authority assignment and modification.
8. Workstation data segregation and modification.

N. Video of Training Sessions:

1. Provide digital video and audio recording of each training session. Create separate recording file for each session.
2. Stamp each recording file with training session number, session name, and date.
3. Provide Owner with two copies of digital files on cloud and flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

END OF SECTION

SECTION 233713.23 - REGISTERS AND GRILLES

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 face registers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 GRILLES

A. Fixed Face Grille:

1. Material: Aluminum.
2. Finish: Baked enamel, color selected by Architect.
3. Core Construction: Removable.
4. Mounting: Countersunk screw.
5. Damper Type: Adjustable opposed blade.

B. Heavy Duty Grille:
1. Material: Steel.
2. Finish: Anodic acrylic, #26 White.
3. Core Construction: Removable.
4. Mounting: Countersunk screw.
5. Damper Type: None.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

City of Grand Rapids Engineering Department

SECTION 263213.16 - GAS-ENGINE-DRIVEN GENERATOR SETS

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. Receiving, installation, and testing of owner provided equipment.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. LP: Liquefied petroleum.

D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Gaseous Fuel Piping:

1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural Gas Piping."

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

2.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Gaseous Fuel Connections:

1. Connect fuel piping to engines with a gate valve and union and flexible connector.
2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
3. Vent gas pressure regulators outside building a minimum of 60 inches from building openings.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

F. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

2.4 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

2.5 FIELD QUALITY CONTROL

A. Testing Agency:

1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
2. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with drawings and specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests in accordance with IEEE 43.

            a) Machines larger than 200 hp. Test duration shall be 10 minutes. Calculate polarization index.
            b) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.

        2) Test protective relay devices.

3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Perform vibration test for each main bearing cap.
6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

L. Refill tank after testing to full level.

M. Provide load bank for testing.

2.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

2.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 263600 - TRANSFER SWITCHES

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. Contactor-type automatic transfer switches.

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 transfer switches.
2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Include material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
4. Riser Diagram: Show interconnection wiring between transfer switches, annunciators, and control panels.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Features and operating sequences, both automatic and manual.
    b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Member company of NETA.

    a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch 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 Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless requirements of these Specifications are stricter.

E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
2. Short-time withstand capability for three cycles.

G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

J. Neutral Terminal: Solid and fully rated unless otherwise indicated.

K. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Accessible via front access.

N. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Caterpillar, Inc.; Electric Power Division.
2. Cummins Power Generation.
3. Emerson.
4. Generac Power Systems, Inc.
5. Kohler Power Systems.
6. MTU Onsite Energy Corporation.

B. Comply with Level 1 equipment according to NFPA 110.

C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Conductor Connectors: Suitable for use with conductor material and sizes.
4. Material: Hard-drawn copper, 98 percent conductivity.
5. Main and Neutral Lugs: Mechanical type.
6. Ground Lugs and Bus-Configured Terminators: Mechanical type.
7. Connectors shall be marked for conductor size and type according to UL 1008.

D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.

1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.

2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts:

    a. Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
    b. Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is unavailable.

2.3 SOURCE QUALITY CONTROL

A. Prepare test and inspection reports.

1. For each of the tests required by UL 1008, performed on representative devices for systems. Include results of test for the following conditions:

a. Overvoltage.
b. Undervoltage.
c. Loss of supply voltage.
d. Reduction of supply voltage.
e. Alternative supply voltage or frequency is at minimum acceptable values.
f. Temperature rise.
g. Dielectric voltage-withstand; before and after short-circuit test.
h. Overload.
i. Contact opening.
j. Endurance.
k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

D. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.

G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
2. Administer and perform tests and inspections with assistance of factory-authorized service representative.

B. Tests and Inspections:

1. After installing equipment, test for compliance with requirements according to NETA ATS.
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with Drawings and Specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, grounding, and required clearances.
    d. Verify that the unit is clean.
    e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
    f. Verify that manual transfer warnings are attached and visible.
    g. Verify tightness of all control connections.
    h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

        1) Use of low-resistance ohmmeter.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

    i. Perform manual transfer operation.

j. Verify positive mechanical interlocking between normal and alternate sources.
k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

3. Electrical Tests:

a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Transfer switches will be considered defective if they do not pass tests and inspections.

F. Remove and replace malfunctioning units and retest as specified above.

G. Prepare test and inspection reports.

H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.

C. Coordinate this training with that for generator equipment.

END OF SECTION

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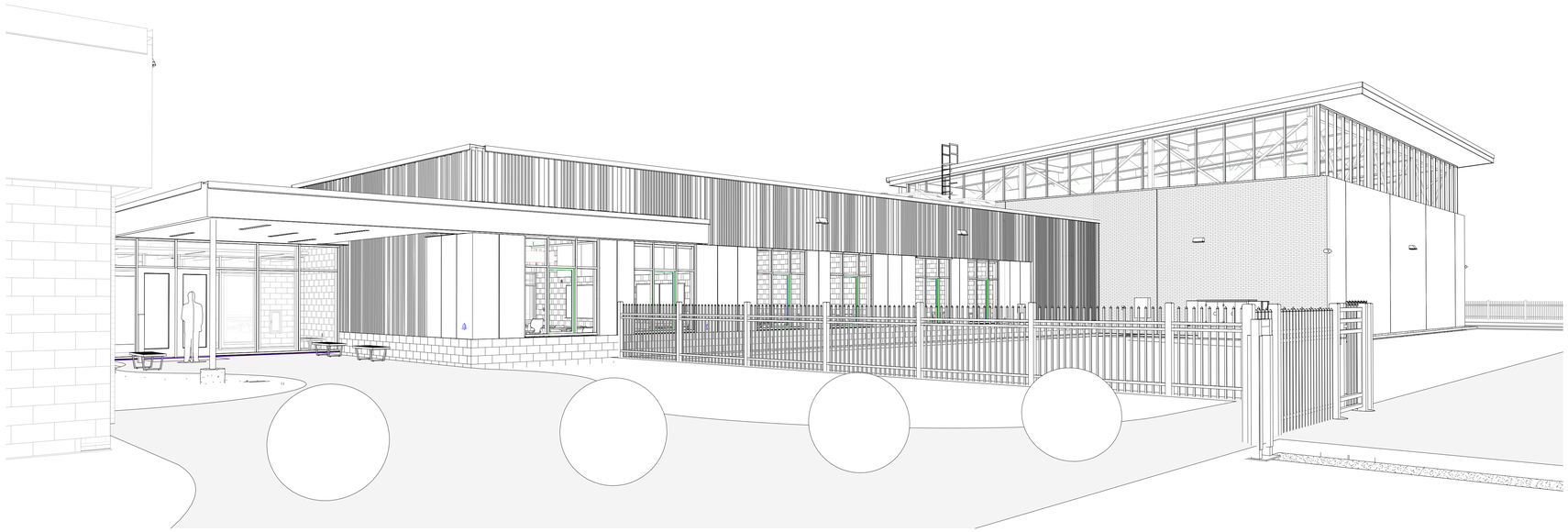

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Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

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Lansing, MI 48911

12/05/25

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PROJECT LOCATION MAP

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02 - CIVIL						
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C200	SITE PLAN		X	X	X	X
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C700	SITE DETAILS		X	X	X	X
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S002	GENERAL NOTES		X	X	X	
S101	FOUNDATION PLAN		X	X	X	
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S103	ROOF FRAMING PLAN	X	X	X	X	
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S501	SECTIONS & DETAILS		X	X	X	
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S503	SECTIONS & DETAILS		X	X	X	
S901	ISOMETRIC VIEWS		X	X	X	
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AD101	FIRST FLOOR DEMOLITION PLANS		X	X	X	
A100	FIRST FLOOR PLAN - OVERALL	X	X	X	X	
A101	FIRST FLOOR PLAN	X	X	X	X	X
A103	ROOF PLAN	X	X	X	X	
A121	FIRST FLOOR CEILING PLAN	X	X	X	X	
A141	FIRST FLOOR FINISH PLAN	X	X	X	X	
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A322	WALL SECTIONS - EXT CORR		X	X	X	
A323	WALL SECTIONS - EXT CLASS		X	X	X	
A324	WALL SECTIONS - EXT GYM		X	X	X	
A325	WALL SECTIONS - INT		X	X	X	
A421	INTERIOR ELEVATIONS	X	X	X	X	X
A422	INTERIOR ELEVATIONS		X	X	X	
A423	INTERIOR ELEVATIONS		X	X	X	

		07/23/25 - SCHEMATIC DESIGN	09/09/25 - DESIGN DEVELOPMENT	10/21/25 - 95% OWNER REVIEW	11/07/25 - BIDS & PERMITS	12/05/25 - ADDENDUM #2
A501	ENLARGED PLAN DETAILS		X	X	X	
A502	ENLARGED PLAN DETAILS			X	X	
A521	SECTION DETAILS			X	X	
A522	SECTION DETAILS			X	X	X
A523	SECTION DETAILS			X	X	X
A531	INTERIOR DETAILS AND MILLWORK			X	X	
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05 - MECHANICAL						
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M120	ROOF MECHANICAL PLAN		X	X	X	
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P102	PLUMBING DOMESTIC WATER GROUND FLOOR PLAN		X	X	X	
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P501	PLUMBING DETAILS		X	X	X	
P502	PLUMBING DETAILS		X	X	X	
P600	PLUMBING SCHEDULES		X	X	X	
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E001	LEGEND		X	X	X	
ES001	ELECTRICAL SITE DEMOLITION PLAN		X	X	X	
ES002	ELECTRICAL SITE PLAN		X	X	X	X
E101	FIRST FLOOR POWER PLAN		X	X	X	
E102	ROOF POWER PLAN		X	X	X	
E201	FIRST FLOOR LIGHTING PLAN		X	X	X	
E601	ONE-LINE DIAGRAM & DETAILS		X	X	X	
E602	DETAILS				X	X
E603	DETAILS				X	X
E801	SCHEDULES		X	X	X	X
09 - TECHNOLOGY (ISSUED FOR REFERENCE ONLY)						
TC101	CABLING LEGENDS, SCHEDULES, AND DETAILS		X	X	X	
TC102	CABLING CONNECTIVITY CODES		X	X	X	
TC103	CABLING DETAILS		X	X	X	
TC104	AUDIO/VISUAL EQUIPMENT DETAILS		X	X	X	
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TC106	SECURITY EQUIPMENT DETAILS			X	X	
TC107	SECURITY EQUIPMENT DETAILS			X	X	
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TC401	AUIDO/VIDEO FLOOR PLANS			X	X	
TC601	SECURITY FLOOR PLANS			X	X	
TR101	RACEWAY LEGENDS, SCHEDULES, AND DETAILS			X	X	
TR102	RACEWAY DETAILS			X	X	
TR103	RACEWAY FLOOR PLANS			X	X	

ALTERNATES

CIVIL:
ALTERNATE C-1 TO INCLUDE INSTALLATION OF WATER SERVICE FROM EXISTING BOILER ROOM TO PROPOSED BUILDING ADDITION AS SHOWN HEREON AS WELL AS ON THE MECHANICAL
ALTERNATE C-2 TO INCLUDE CONNECTION TO THE EXISTING WATERMAIN IN WEXFORD AVENUE WITH A TAPPING SLEEVE & VALVE, INSTALLATION OF NEW 8" WATERMAIN, BENDS & FITTINGS AS NECESSARY TO DELIVER A PUBLIC WATERMAIN EXTENSION AS REQUIRED BY THE CITY OF LANSING TO THE NEW HYDRANT NEAR THE SE CORNER OF THE PROPOSED BUILDING ADDITION. PRICING FOR THIS ALTERNATE SHALL INCLUDE SAWCUTTING, REMOVAL AND REPLACEMENT OF CONCRETE CURBS & GUTTERS, WALKS, AND PAVEMENTS WITHIN 7.5' OF EITHER SIDE OF THE 8" WATERMAIN SHOWN, AS WELL AS PROTECTION OF ALL EXISTING BURIED UTILITIES, SITE LIGHTING, DUMPSTER ENCLOSURE ETC... AND RESTORATION OF ALL LAWN AND LANDSCAPED AREAS DISTURBED DURING THE TRENCHING AND INSTALLATION OF THE NEW CL-53 DUCTILE IRON WATERMAIN

ARCHITECTURAL:
ALTERNATE A-1 TO SUPPLY AND INSTALL ROLLER SHADES WS-1 AT CORRIDOR EXTERIOR GLAZING

ELECTRICAL:
ALTERNATE E-1 TO INCLUDE GENERATOR FOR GRINDER PUMP IF REQUIRED BY AHJ. PROVIDE 25KW NATURAL GAS GENERATOR

REV	DATE	DESCRIPTION
1	07/23/25	SD OWNER REVIEW
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

MI ARCHITECTURE
FIRM LICENSE # NLP000605

STATE OF MICHIGAN
GEORGE E. HUYLER, JR
ARCHITECT
NO. 1301046947
LICENSED ARCHITECT

DRAWING NUMBER:
G000

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

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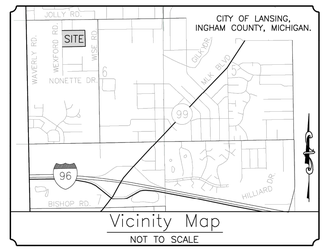


Vicinity Map

NOT TO SCALE

BENCHMARKS (BM)

ELEVATIONS ARE DERIVED FROM GPS OBSERVATIONS REFERENCING GRS80/GEOID18 TO DETERMINE ELEVATIONS IN THE NAVD88 VERTICAL DATUM.

BENCHMARK NO. 3128
TOP OF NORTHEAST BOLT WITH "BURY" TAG ON FIRE HYDRANT, LOCATED NEAR THE SOUTHWEST CORNER OF THE PARCEL.
ELEVATION: 877.58 (NAVD88 DATUM).

BENCHMARK NO. 1121
TOP OF SOUTHEAST BOLT NEXT TO THE "N" IN "OPEN" ON FIRE HYDRANT, LOCATED NEAR THE NORTHWEST CORNER OF THE PARCEL.
ELEVATION: 880.64 (NAVD88 DATUM).

CONTROL POINTS (CP)

CONTROL POINT NO. 86753
5/8" BAR WITH GDI TRAVERSE CAP LOCATED IN A LAWN ISLAND IN THE PARKING
NORTHING: 430273.67, EASTING: 13061395.16
ELEVATION: 879.44 (NAVD88 DATUM).

CONTROL POINT NO. 3004 – 1/2" STEEL BAR AND BROKEN CAP AT THE NORTHWEST PARCEL CORNER.
NORTHING: 430704.47, EASTING: 13061243.26
ELEVATION: 878.6 (NAVD88 DATUM).

GENERAL NOTES

1) UTILITY LINES SHOWN WERE BASED ON PLANS PROVIDED UNDER A MISS DIG DEMAC TICKET NO. 2025063000362.

2) DIMENSIONS SHOWN ARE IN INTERNATIONAL FEET AND DECIMALS THEREOF.

3) THE WORD "CERTIFY" OR "CERTIFICATION" AS USED HEREIN IS AN EXPRESSION OF A PROFESSIONAL OPINION BY THE SURVEYOR BASED UPON HIS BEST KNOWLEDGE, INFORMATION, AND BELIEF, AS SUCH, IT DOES NOT CONSTITUTE A GUARANTEE OR WARRANTY, EXPRESSED OR IMPLIED, OR LEGAL OPINION.

4) REFERENCED DRONE PHOTOGRAMMETRY OBSERVED AND PROCESSED BY GEODETIC DESIGNS INC. ON 08JULY2025.

FEMA 100 YEAR FLOODPLAIN

BY GRAPHIC PLOTTING ONLY, THIS PARCEL IS LOCATED IN ZONE X OF THE FLOOD INSURANCE RATE MAP NUMBER 26065C0136D WHICH BEARS AN EFFECTIVE DATE OF 8/16/2011.

STORM INVENTORY

CB = CATCH BASIN
STMH = STORM MANHOLE

CB 1355
RIM: 878.74
SUMP: 875.7
CAN'T SEE PIPE

STMH 1175
RIM: 879.98
10" NE: 873.7
18" NW: 872.6
12" S: 872.6

STMH 1215
RIM: 880.47
12" N: 872.9
12" S: 873.0
12" E: 873.0

STMH 1255
RIM: 879.74
12" N: 874.3
10" E: 874.3
6" PVC S: 874.5

STMH 3172
RIM: 879.62
6" PVC N: 874.3
12" S: 875.8

STMH 3173
RIM: 879.18
12" N: 875.8
12" S: 873.4

STMH 3262
RIM: 878.89
12" W: 873.1
12" SE: 873.1
T/WATER: 875.9
SUMP: 873.0

CB 3192
RIM: 878.09
12" N: 873.5
12" E: (CAN'T SEE)
T/WATER: 876.0
SUMP: 870.4

CB 3254
RIM: 878.95
10" E: 874.8
10" W: 874.8

CB 3437
RIM: 877.39
12" NW: 873.5
6" S: 874.0
T/WATER: 875.9
SUMP: 870.4

STMH 3596
RIM: 881.16
10" W: 876.3
10" NE: 876.8

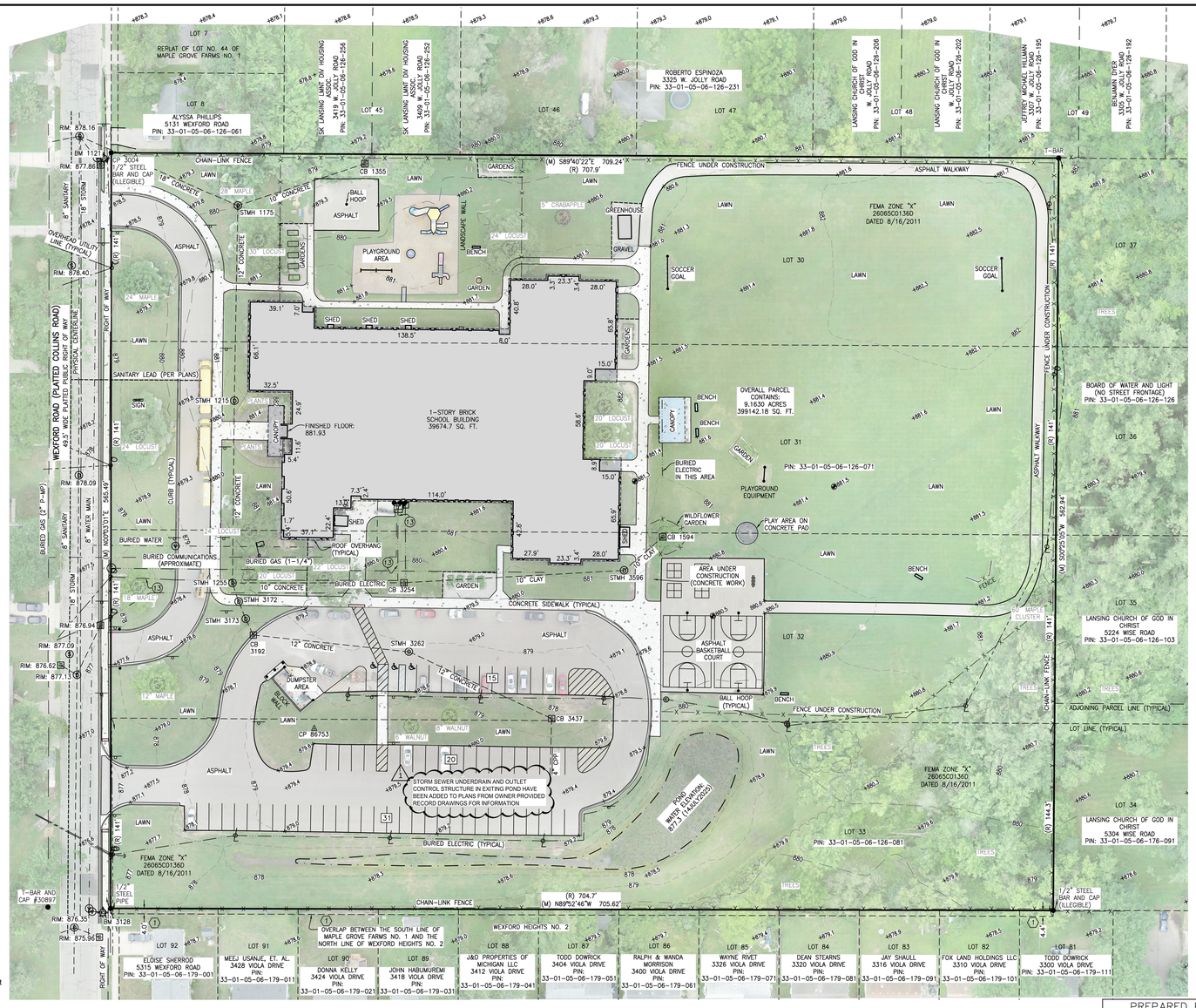
CB 1594
RIM: 879.51
10" SW: 877.1

LEGEND

- Power Pole
- Power Pole w/Light
- Light Pole
- Telephone Pole
- Guy Wire
- Transformer
- Electric Manhole
- Telephone Manhole
- Telephone Pedestal
- Electric Meter
- Cable Box
- Air Conditioner Unit
- Easement Identifier
- Distance not to scale
- Flag Pole
- Sign (As Noted)
- Well Head
- Satellite Dish
- Tower
- Water Valve
- Fire Hydrant
- Water Manhole
- Water Meter Pit
- Water Meter
- Indicates Handicapped Parking
- Parking Count
- Mailbox
- Storm Manhole
- Storm Catchbasin
- Deciduous Tree
- Coniferous Tree
- Sanitary Manhole
- Sanitary Clean Out
- Gas Valve
- Gas Manhole
- Gas Meter
- Gas Marker
- Section Corner
- Set 5/8" Bar & Cap
- Found Corner Monument
- Monitoring Well

ABBREVIATIONS

R = RECORDED	T–N = TOWN – NORTH	AVE. = AVENUE
M = MEASURED	R–E = RANGE – EAST	BLVD. = BOULEVARD
C = CALCULATED	SQ. FT. = SQUARE FEET	CT. = COURT
N = NORTH	NE = NORTHEAST	RD. = ROAD
E = EAST	SE = SOUTHEAST	ST. = STREET
S = SOUTH	SW = SOUTHWEST	PIN = PARCEL IDENTIFICATION NUMBER
W = WEST	NW = NORTHWEST	



LINETYPE LEGEND

- UNDERGROUND ELECTRIC LINE
- OVERHEAD UTILITY LINE
- GAS LINE
- WATER LINE
- STORM SEWER
- SANITARY SEWER
- BURIED COMMUNICATIONS
- FENCE
- PARCEL LINE
- ADJOINING PARCEL LINE

UTILITY PROVIDERS

Station Code	Authority Name	Phone	Status
ATTD	AT&T TELEPHONE	6168812268	Notification Sent
COMTV4CTV	COMCAST CABLE TV	8559628525	Notification Sent
CEGDIS	CONSUMERS ENERGY GAS	2195002070	Notification Sent
LANBW2ELE	LANSING BOARD OF WATER & LIGHT ELECTRIC	5177027030	Notification Sent
LANBW2WTR	LANSING BOARD OF WATER & LIGHT POTABLE WATER	5177027030	Notification Sent
LANSCYSANI	LANSING CITY PUBLIC SERVICE SANITARY SEWER	5174834161	Notification Sent
LANSCYSTRM	LANSING CITY PUBLIC SERVICE STORM SEWER	5174834161	Notification Sent
MFNFBR	METRO FIBERNET, LLC FIBER OPTICS	3173663596	Notification Sent
ZAYOMI	ZAYO BANDWIDTH MIDWEST, LLC FIBER OPTICS	8009616500	Notification Sent

UNDERGROUND UTILITY NOTE

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD OBSERVATIONS AND/OR EXISTING DRAWINGS AS PROVIDED BY THE FACILITY OWNER. THE UNDERGROUND UTILITIES SHOWN MAY NOT COMPRISE ALL SUCH UTILITIES ON OR NEAR THE SURVEYED PARCEL, EITHER IN SERVICE OR ABANDONED. THE LOCATION OF BURIED UTILITIES ARE SHOWN TO INDICATE THAT A UTILITY EXIST, BUT MAY REQUIRE SUB-SURFACE INVESTIGATION TO DETERMINE THE EXACT LOCATION.

0' 40' 80'

SCALE: 1"=40'

A PART OF THE NORTHWEST ONE-QUARTER OF SECTION 6, TOWNSHIP 3 NORTH, RANGE 2 WEST, DELHI TOWNSHIP, INGHAM COUNTY, MICHIGAN
PIN: 33-01-05-06-126-071 & 33-01-05-06-126-081

DESCRIPTION

PER TITLE REPORT:

Lots 30, 31, 32, and 33, Plat of Maple Grove Farms No. 1, City of Lansing, Ingham County, Michigan, as recorded in Liber 8 of Plats, Page 24.

DESCRIPTION PER TAX RECORDS:

PIN: 33-01-05-06-126-081
Lot 33, MAPLE GROVE FARMS NO. 1, a subdivision of a part of the Northwest one-quarter of Section 6, Township 3 North, Range 2 West, Delhi Township, Ingham County, Michigan, according to the recorded plat thereof, as recorded in Liber 8 of Plats, page 24, Ingham County records

PIN: 33-01-05-06-126-071
Lots 30, 31, & 32, MAPLE GROVE FARMS NO. 1, a subdivision of a part of the Northwest one-quarter of Section 6, Township 3 North, Range 2 West, Delhi Township, Ingham County, Michigan, according to the recorded plat thereof, as recorded in Liber 8 of Plats, page 24, Ingham County records

SIGNIFICANT OBSERVATIONS

1 AN OVERLAP EXISTS BETWEEN THE SOUTH LINE OF MAPLE GROVE FARMS NO. 1 AND THE NORTH LINE OF WEXFORD HEIGHTS NO. 2 PER THE RECORD PLAT DIMENSIONS AS SHOWN HEREON. THE NORTH LINE OF WEXFORD HEIGHTS NO. 2 IS SHOWN BASED ON RECOVERED MONUMENTATION.

COORDINATE METADATA

The coordinates for this survey are based on the Michigan Coordinate System of 1983 (1964 PA 9) as determined locally by GPS observations on 14–July–2025. The nearest reference station is:

AM7017 LANSING CORS ARP

The combined scale factor (CSF) for the project area is: 0.9998763
The spatial reference system is: NAD83(2011) epoch 2010.00
The vertical datum is NAVD88 as derived from GPS observations referencing (GRS80/Geoid18).

The ground (local grid) scale factor for the project area is: 1.00012368
The local control point for this project is control point #86753 and has the following standard deviation:

Northing – 0.02 ift
Easting – 0.02 ift
Elevation – 0.03 ift

NOTES CORRESPONDING TO SCHEDULE B

10 Easement(s), terms, conditions and provisions which are recited in Drainage Easement recorded in Liber 63 of Misc. Records, Page 517. The route and course of the drain described in this document is illegible and not shown hereon.

11 Easement(s), terms, conditions and provisions which are recited in Drainage Easement recorded in Liber 67 of Misc. Records, Page 317. The route and course of the drain described in this document is illegible and not shown hereon.

12 Covenants, conditions and restrictions and other provisions but omitting restrictions, if any, based on race, color, religion, sex, handicap, familial status or national origin as contained in instrument recorded in Liber 335, Page 200. This item does not describe the parcels in the deed description and not shown hereon.

13 Right(s) of Way and/or Easement(s) and the rights incidental thereto, as granted in a document in Liber 968, Land 621, Granted to: Consumers Power Company (now known as Consumers Energy) Assigned in Liber 978, Page: 1057. This item crosses or touches the parcel and is shown hereon.

BEARING BASIS

BEARINGS ARE BASED ON THE EAST LINE OF WEXFORD ROAD (PLATTED COLLINS ROAD), PER GRID NORTH REFERENCING THE MICHIGAN COORDINATE SYSTEM OF 1983 (SOUTH ZONE) BEARING NORTH 00°03'01" EAST.

CERTIFICATION:

I HEREBY CERTIFY TO PARTIES NAMED HEREON THAT THIS PROJECT WAS COMPLETED UNDER MY DIRECT AND RESPONSIBLE CHARGE FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION; THAT THIS TOPOGRAPHIC SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS. THE ORIGINAL DATA WAS OBTAINED ON 14–JULY–2025; ALL COORDINATES ARE BASED ON A GRID PROJECTION IN INTERNATIONAL FEET AND ALL ELEVATIONS ARE BASED ON THE NAVD88 VERTICAL DATUM DERIVED FROM GPS OBSERVATIONS REFERENCING NGS CONTROL STATIONS.

STATE OF MICHIGAN
Gilbert Marshall Barish
PROFESSIONAL SURVEYOR
No. 4001047942
REGISTERED PROFESSIONAL SURVEYOR

GILBERT M. BARISH, P.S. #4001047942

TOPOGRAPHIC BOUNDARY SURVEY

PREPARED BY:

GEODETIC DESIGNS, INC.
2300 N. GRAND RIVER AVE.
LANSING, MI 48906
PHONE: (517) 908–0008
FAX: (517) 908–0009
WWW.GEODETICDESIGNS.COM

DATE	REVISION	BY
07AUG2025	TITLE REPORT AND DOCUMENTS	GMB

COLLIERS ENGINEERING

5217 Wexford Road
Lansing, MI 48911
Wexford Montessori Academy

DATE: 14–JULY–2025	SCALE: 1" = 40'
DRAWN BY: JC	JOB NUMBER: S114–2025
CHECKED BY: GB	SHEET 1 OF 1

Colliers
Engineering & Design
www.colliersengineering.com

REV	DATE	DESCRIPTION
	11/07/25	ISSUE FOR BIDS
1	12/05/25	ADDENDUM 02

Lansing School District

CLASSROOM & GYM ADDITIONS FOR

WEXFORD MONTESSORI ACADEMY

5217 WEXFORD RD
INGHAM COUNTY
LANSING MI 48911

NOT FOR CONSTRUCTION

Colliers Engineering & Design
LANSING (BA)
7050 West Saginaw Hwy.
Suite 200
Lansing, MI 48917
Phone: 517.272.9835
COLLIERS ENGINEERING & DESIGN, ARCHITECTURE, LANDSCAPE ARCHITECTURE, SURVEYING CT, P.C.

SCALE: AS SHOWN	DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA	REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025	PROJECT NUMBER: 25009299A

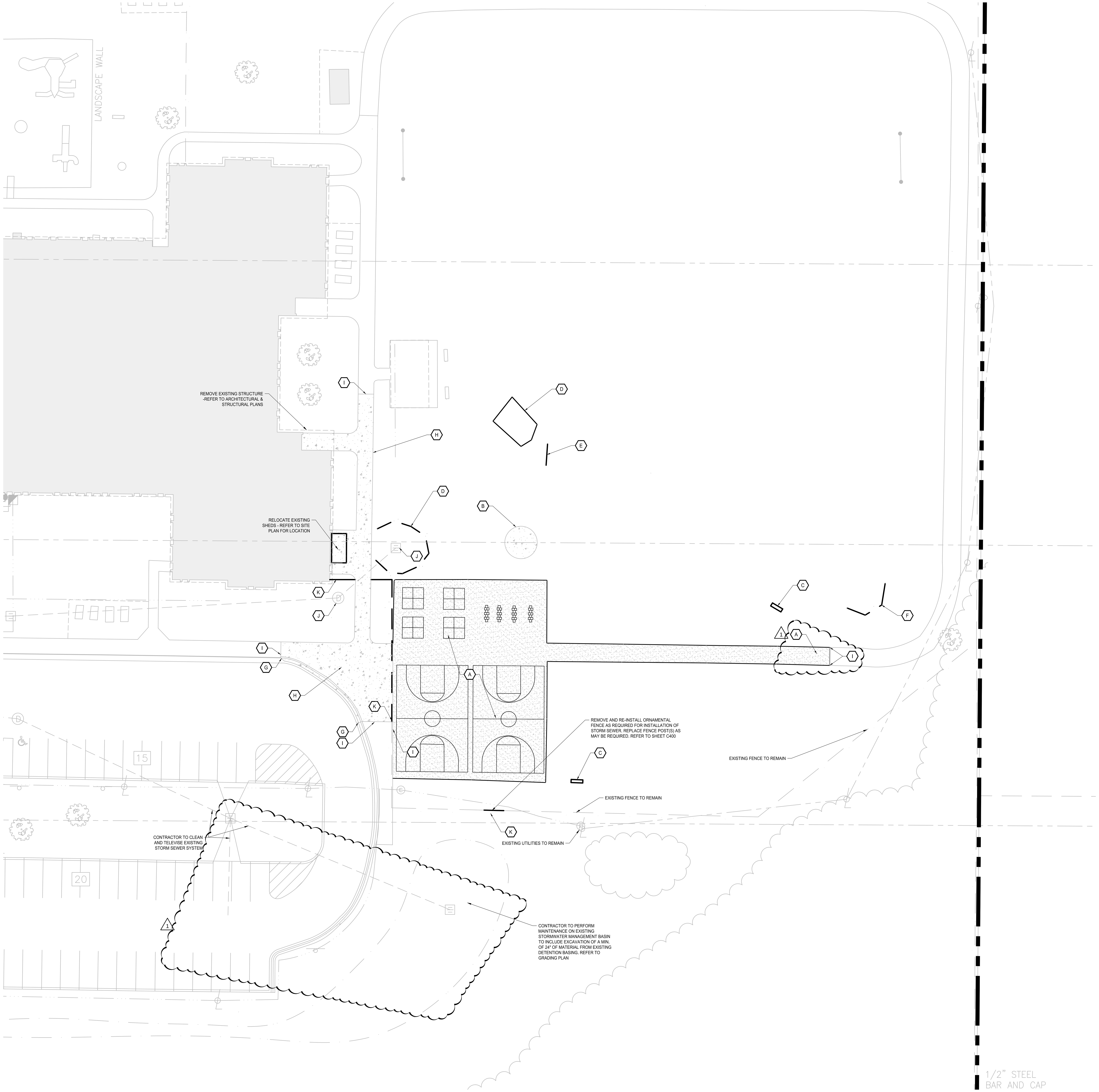
SHEET NAME:

TOPOGRAPHIC BOUNDARY SURVEY

DRAWING NUMBER:

C001

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.



DEMOLITION NOTES:

1. APPURTENANCES DESIGNATED FOR DEMOLITION SHALL NOT BE DISTURBED BY THE CONTRACTOR UNTIL FURNISHED WITH NOTICE OF POSSESSION AND APPROVAL TO PROCEED FROM OWNER AND ACQUISITION OF ALL APPROPRIATE CONTRACTS. THE CONTRACTOR SHALL COORDINATE THE SCHEDULE WITH EXISTING TENANTS AND ADJACENT PROPERTY OWNERS. FOUNDATIONS, SLABS, ALL UNDERGROUND STRUCTURES, AND UTILITIES DESIGNATED FOR REMOVAL SHALL BE REMOVED ENTIRELY UNLESS OTHERWISE NOTED. AREAS TO BE BACK FILLED IN ACCORDANCE WITH GEOTECHNICAL REPORT.
2. CONTRACTOR IS SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING UTILITIES THAT ARE INTENDED TO PROVIDE SERVICE WHETHER SHOWN ON THE PLANS OR NOT.
3. CONTRACTOR TO VERIFY THAT ALL UTILITIES HAVE BEEN ABANDONED OR PROPERLY SHUTOFF PRIOR TO EXCAVATION.
4. EXISTING UTILITIES AND TOPO LOCATIONS ARE BASED ON THE BEST AVAILABLE INFORMATION. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL EXISTING UTILITY LOCATIONS.
5. PRIOR TO INITIATING DEMOLITION WORK, THE CONTRACTOR SHALL DEVELOP A DIGITAL PHOTOGRAPH AND/OR VIDEO RECORD OF THE EXISTING STRUCTURES AND SURROUNDING PROPERTIES. THE RECORD SHALL INCLUDE CONDITIONS OF EXISTING STREETS AND ADJACENT PROPERTIES. ONE COPY OF THE PHOTOGRAPH AND/OR VIDEO RECORD SHALL BE PROVIDED TO THE OWNER.
6. ALL DEBRIS FROM DEMOLITION, NOT BEING REUSED, SHALL BE HAULED OFF SITE AND DISPOSED OF BY LEGAL MEANS.
7. CONTRACTOR SHALL ERECT AND MAINTAIN TEMPORARY FENCE, 6 FOOT MINIMUM HEIGHT, FOR THE DURATION OF ALL DEMOLITION PHASES.
8. CONTRACTOR SHALL NOT RESTRICT ACCESS TO ADJOINING PROPERTIES DURING DEMOLITION OR CONSTRUCTION. ACCESS SHALL BE MAINTAINED SO AS NOT TO INTERRUPT NORMAL OPERATIONS OF ADJACENT FACILITIES.
9. CONTRACTOR SHALL NOT ALLOW ANY UTILITY OR SERVICES TO THE NEIGHBORING PROPERTY(S) TO BE INTERRUPTED WITHOUT THE EXPRESSED WRITTEN PERMISSION OF THE RESPECTIVE OWNERS. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN ALL UTILITY SERVICES TO THE NEIGHBORING BUILDINGS. IF IT IS NECESSARY FOR CONNECTIONS TO BE INTERRUPTED, THE CONTRACTOR IS RESPONSIBLE TO PROVIDE TEMPORARY SERVICES (I.E.. GENERATORS, PORTABLE GAS TANKS, ETC.). THE CONTRACTOR IS RESPONSIBLE TO COORDINATE ALL UTILITY ABANDONMENT AND REMOVAL WITH THE RESPECTIVE UTILITY COMPANIES.
10. WORK CANNOT OCCUR OUTSIDE OF THE DEMOLITION LIMITS WITHOUT PRIOR CONSENT OF OWNER, ADJACENT OWNER, AND LOCAL JURISDICTION.
11. EROSION CONTROL PRACTICES MUST BE IN PLACE AND MAINTAINED DURING DEMOLITION.
12. BASED ON OWNER PROVIDED RECORD PLANS, THE EXISTING WALKING TRACK CONSISTS OF 3" HMA PAVEMENT, 8" AGGREGATE BASE, GEOGRID (TENSAR TX-160), 12" SAND SUBBASE, GEOTEXTILE FABRIC. WHERE GEOGRID IS NOT PRESENT, THE SUBGRADE PASSED PROOF ROLL DURING CONSTRUCTION.
13. IN THE EVENT GEOGRID IS ENCOUNTERED DURING CONSTRUCTION OF THE PROPOSED IMPROVEMENTS, CONTRACTOR SHALL SAWCUT AND REMOVE AN ADDITIONAL 5 FEET OF THE EXISTING ASPHALT WALKING TRACK TO ALLOW FOR REPLACEMENT OF THE GEOGRID AND OVERLAPPING OF THE GEOGRID A MIN. OF 24" PRIOR TO PLACEMENT OF THE NEW AGGREGATE BASE.

KEY NOTES: (A)

A. REMOVE ASPHALT PAVEMENT AND SPORTS COURT, INCLUDING BASKETBALL POST AND BACKBOARD.
B. REMOVE & SALVAGE GAGA PIT & REMOVE CONCRETE SLAB. RELOCATE GAGA PIT AS CALLED FOR ON SITE PLAN
C. REMOVE AND RELOCATE BENCH & CONCRETE PAD, WHERE APPLICABLE.
D. REMOVE BUTTERFLY GARDEN - RELOCATE AS SHOWN ON SITE PLAN.
E. REMOVE PLAYGROUND STRUCTURES
F. REMOVE CHAIN LINK PLAYGROUND FENCE / BACKSTOP & CONCRETE POST FOUNDATIONS
G. SAWCUT & REMOVE CONCRETE CURB & GUTTER
H. SAWCUT AND REMOVE CONCRETE SIDEWALK
I. SAWCUT PAVEMENT AT LIMITS OF REMOVAL
J. ADJUST DRAINAGE STRUCTURE TO NEW GRADE. REFER TO UTILITY PLAN FOR ADDITIONAL INFORMATION.
K. REMOVE ORNAMENTAL FENCE, CONCRETE FOOTINGS AND MAINTENANCE STRIP, WHERE APPLICABLE. SALVAGE FENCE PANELS & EXISTING DOUBLE SWING GATE & HARDWARE FOR RE-INSTALLATION AS CALLED FOR ON SITE PLAN. LIMITS OF ORNAMENTAL FENCE REMOVAL ADJACENT TO EXISTING BASKETBALL COURTS TO BE COORDINATED BY CONTRACTOR IN FIELD. ANY FENCE DAMAGED OR REMOVED SHALL BE REPLACED IN KIND.

SITE LEGEND:

- PROPERTY LINE
- SAWCUT AND REMOVE EXISTING CONCRETE
- SAWCUT AND REMOVE EXISTING ASPHALT
- (A) KEY NOTE

N

0 20 40 60 FT
1" = 20' SCALE BAR

Colliers Engineering & Design

www.colliersengineering.com

REV	DATE	DESCRIPTION
	11/07/25	ISSUE FOR BIDS
1	12/05/25	ADDENDUM 02

Lansing School District

CLASSROOM & GYM ADDITIONS FOR

WEXFORD MONTESSORI ACADEMY

5217 WEXFORD RD
INGHAM COUNTY
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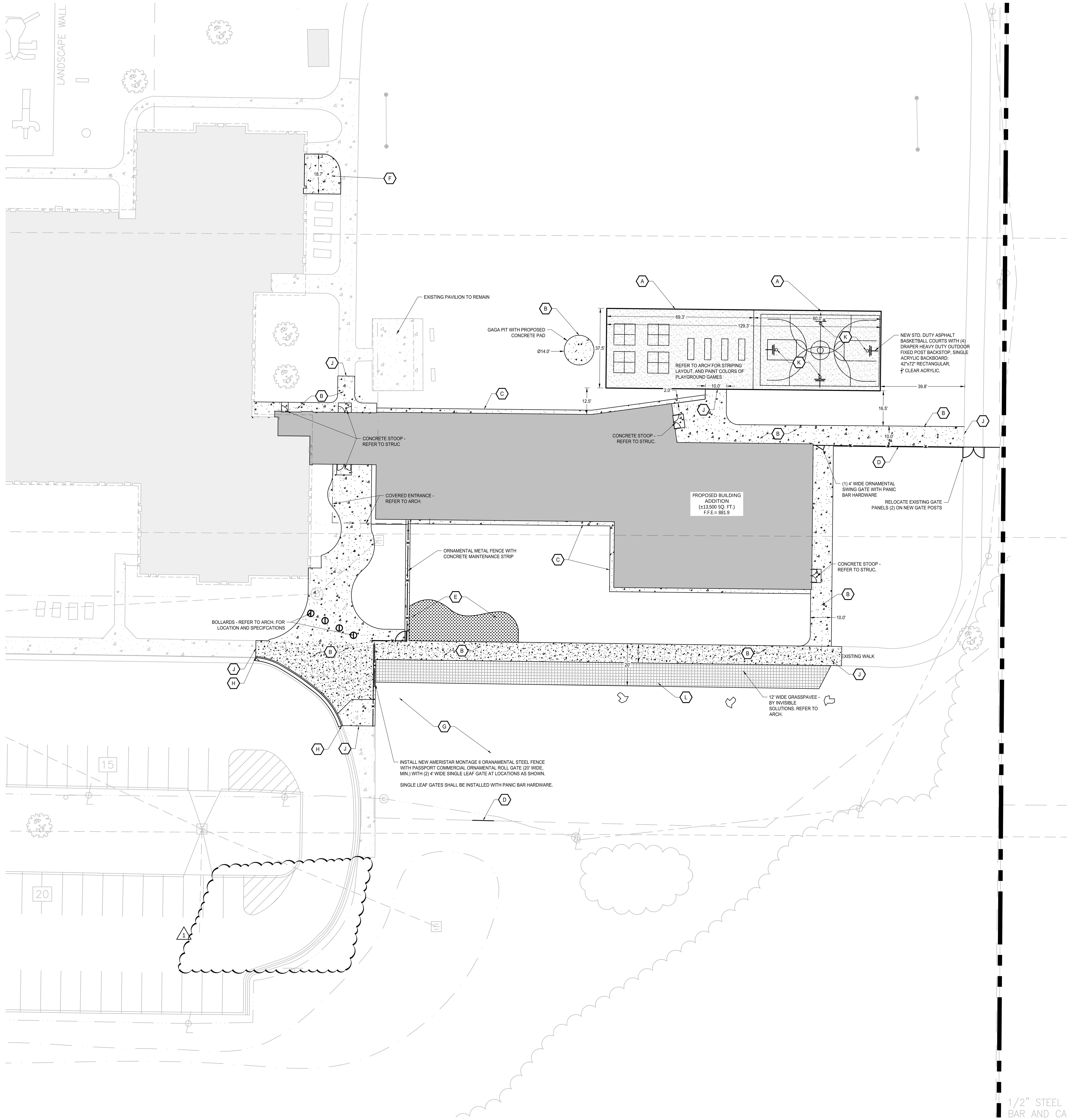
Lansing, MI 48917
Phone: 517.272.9835
COLLIERS ENGINEERING & DESIGN, ARCHITECTURE, LANDSCAPE ARCHITECTURE, SURVEYING CT, P.C.

SCALE:	DRAWN BY:
AS SHOWN	A. BOCKTING
DESIGNED BY:	REVIEWED BY:
J. ROZEMA	J. ROZEMA
DATE ISSUED:	PROJECT NUMBER:
12/03/2025	25009299A

SHEET NAME:
DEMOLITION PLAN

DRAWING NUMBER:
C100

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.



GENERAL NOTES:

1. THE UNDERGROUND STRUCTURES AND UTILITIES SHOWN ON THESE PLANS HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORD MAPS, THEY ARE NOT CERTIFIED TO THE ACCURACY OF THEIR LOCATION AND/OR COMPLETENESS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION AND EXTENT OF ALL UNDERGROUND STRUCTURES AND UTILITIES PRIOR TO ANY DIGGING OR CONSTRUCTION ACTIVITIES IN THEIR VICINITY.
2. THE CONTRACTOR SHALL PERFORM ALL WORK IN COMPLIANCE WITH TITLE 29 OF FEDERAL REGULATIONS, PART 1926, SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION (OSHA).
3. ALL ROADS AND PRIVATE DRIVES SHALL BE KEPT CLEAN OF MUD, DEBRIS ETC. AT ALL TIMES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR PRECISE BUILDING DIMENSIONS.
5. THE CONTRACTOR SHALL CONSULT THE CONSTRUCTION MANAGER BEFORE DEVIATING FROM THESE PLANS.
6. IN ALL TRENCH EXCAVATIONS, CONTRACTOR MUST LAY THE TRENCH SIDE SLOPES BACK TO A SAFE SLOPE, USE A TRENCH SHIELD OR PROVIDE SHEETING AND BRACING.
7. ALL EXISTING SURFACE APPURTENANCES (I.E. WATER VALVES, CATCH BASIN FRAMES AND GRATES, MANHOLE COVERS) WITHIN THE PROJECT LIMITS SHALL BE ADJUSTED TO FINISHED GRADE.
8. AREAS DISTURBED OR DAMAGED AS PART OF THIS PROJECT'S CONSTRUCTION THAT ARE OUTSIDE OF THE PRIMARY WORK AREA SHALL BE RESTORED, AT THE CONTRACTOR'S EXPENSE, TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE.
9. THE CONTRACTOR SHALL CALL "MISS DIG" AT LEAST 3 WORKING DAYS (EXCLUDING WEEKENDS AND HOLIDAYS) PRIOR TO CONSTRUCTION.
10. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE APPLICABLE CODES, ORDINANCES, DESIGN STANDARDS AND STANDARD SPECIFICATIONS OF THE AGENCIES WHICH HAVE THE RESPONSIBILITY OF REVIEWING PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF ALL ITEMS INCLUDED IN THESE PLANS.
11. UNLESS SPECIFICALLY STATED, THE CONTRACTOR SHALL APPLY FOR AND OBTAIN ALL NECESSARY PERMITS AS REQUIRED FOR CONSTRUCTION OF THIS PROJECT PRIOR TO THE BEGINNING OF WORK FROM THE PREVIOUSLY MENTIONED AGENCIES.
12. THE CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
13. WHEN ANY EXISTING UTILITY REQUIRES ADJUSTMENT OR RELOCATION, THE CONTRACTOR SHALL NOTIFY THE PROPER UTILITY COMPANY AND COORDINATE THE WORK ACCORDINGLY. THERE SHALL BE NO CLAIM MADE BY THE CONTRACTOR FOR ANY COSTS CAUSED BY DELAYS IN CONSTRUCTION DUE TO THE ADJUSTMENT OR RELOCATION OF UTILITIES.
14. THE CONTRACTOR IS TO VERIFY THAT THE PLANS AND SPECIFICATIONS THAT HE/SHE IS BUILDING FROM ARE THE VERY LATEST PLANS AND SPECIFICATIONS THAT HAVE BEEN APPROVED BY ALL APPLICABLE PERMIT-ISSUING AGENCIES AND THE OWNER. ALL ITEMS CONSTRUCTED BY THE CONTRACTOR PRIOR TO RECEIVING THE FINAL APPROVAL AND PERMITS HAVING TO BE ADJUSTED OR RE-DONE, SHALL BE DONE AT THE CONTRACTOR'S EXPENSE.
15. SHOULD THE CONTRACTOR ENCOUNTER CONFLICT BETWEEN THESE PLANS AND SPECIFICATIONS, EITHER AMONG THEMSELVES OR WITH THE REQUIREMENTS OF ANY AND ALL REVIEWING AND PERMIT-ISSUING AGENCIES, HE/SHE SHALL SEEK CLARIFICATION IN WRITING FROM THE CONSTRUCTION MANAGER BEFORE COMMENCEMENT OF CONSTRUCTION. FAILURE TO DO SO SHALL BE AT THE SOLE EXPENSE TO THE CONTRACTOR.
16. THE CONTRACTOR SHALL FURNISH AS-BUILT DRAWINGS INDICATING ALL CHANGES AND DEVIATIONS FROM APPROVED DRAWINGS.
17. ALL SIGNS AND TRAFFIC CONTROL MEASURES DURING CONSTRUCTION AND MAINTENANCE ACTIVITIES SHALL BE CONSTRUCTED AND INSTALLED PER THE LATEST EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (M.M.U.T.C.D.).
18. ALL WORK WITHIN THE PUBLIC RIGHT OF WAY SHALL CONFORM TO THE STANDARDS OF THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

KEY NOTES:

A. ASPHALT PAVEMENT SECTION - HD OR STANDARD AS NOTED ON PLANS
B. CONCRETE SIDEWALK. - REFER TO ARCHITECTURE FOR SCORING AND DIMENSIONS.
C. 2' CONCRETE MAINTENANCE STRIP. REFER TO ARCH. PLANS FOR DETAILS
D. PROPOSED 4' TALL BLACK 3 RAIL ORNAMENTAL FENCE TO MATCH EXISTING.
E. NATIVE WILDFLOWER AREA - TO BE PLANTED BY OWNER
F. RELOCATE EXISTING RESIN SHED. INSTALL ON NEW 6" CONCRETE PAD.
G. ALL DISTURBED AREAS TO RESTORED WITH NEW LAWN/GRASS AREA (HYDROSEED) W/ 4" CLEAN TOPSOIL & FERTILIZER UNLESS OTHERWISE NOTED. - REFER TO LANDSCAPE PLAN.
H. ROLLED CONCRETE CURB AND GUTTER - PROVIDE TRANSITION FROM FULL HIGH CURB TO PROPOSED CURB SECTION ACROSS 6 FEET.
I. RECONSTRUCT CONCRETE CURB AND GUTTER - MATCH EXISTING CROSS SECTION
J. CONSTRUCT THICKENED EDGE WALF AT CONNECTION TO EXISTING CONCRETE ASPHALT WALK, TYP. TIE NEW CONCRETE TO EXISTING IN ACCORDANCE WITH CONCRETE WALKWAY CONNECTION AT ALL THICKENED EDGE LOCATIONS AS NOTED ON PLANS
K. BASKETBALL BACKSTOP - DRAPER, HEAVY DUTY OUTDOOR FIXED POST BACKSTOP (4 TOTAL), MODEL 50695. CENTER OF POST TO BE POSITIONED 66" FROM FACE OF BACKBOARD IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
L. EMERGENCY VEHICLE ACCESS DRIVE. INSTALL GRASS PAVE2, BY INVISIBLE STRUCTURES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

REFER TO DETAILS ON SHEET C700.

SITE LEGEND:

- PROPERTY LINE
- STANDARD DUTY CONCRETE
- HEAVY DUTY CONCRETE
- ASPHALT
- LANDSCAPED AREA
- (A) KEY NOTE

ORNAMENTAL FENCE NOTES:

1. RE-INSTALL SALVAGED ORNAMENTAL FENCE PANELS AND PROVIDE NEW PANEL SECTIONS AS REQUIRED TO PROVIDE FULL LENGTH OF FENCE AS SHOWN.
2. PROVIDE 4' WIDE SINGLE SWING GATES WITH PANIC HARDWARE.
3. PROVIDE PASSPORT COMMERCIAL ORNAMENTAL ROLL GATE (22' WIDE) WITH ALL FITTINGS AND FIXTURES TO PROVIDE A FULLY OPERATING MANUAL SLIDING GATE IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
4. ALL ORNAMENTAL FENCE TO BE AMERISTAR MONTAGE II, MAJESTIC 3-RAIL FENCE AND GATES AS DETAILED ON SHEET C701.

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Lansing School District

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WEXFORD MONTESSORI ACADEMY

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INGHAM COUNTY
LANSING MI 48911

NOT FOR CONSTRUCTION

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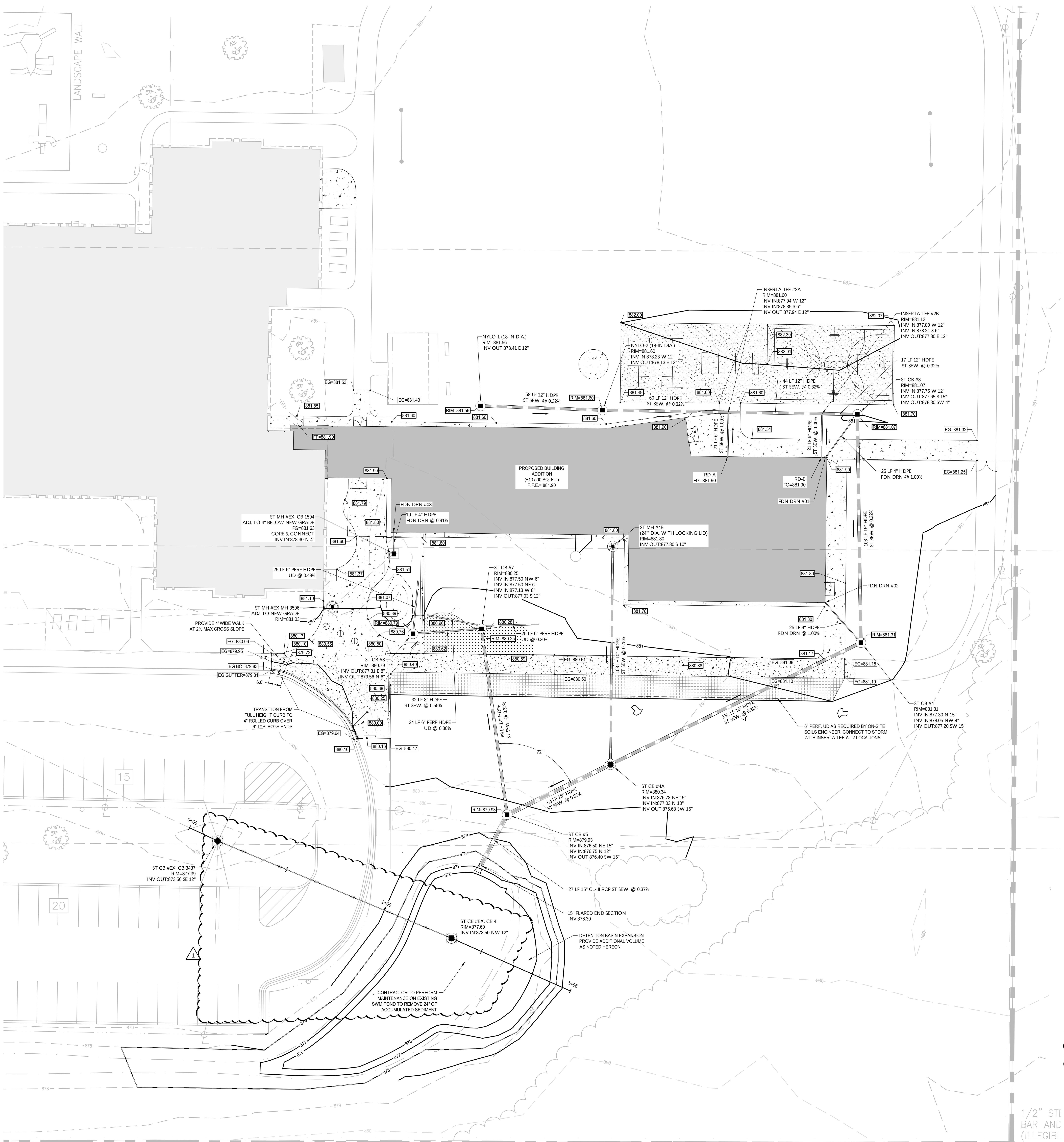
SCALE: AS SHOWN	DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA	REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025	PROJECT NUMBER: 25009299A

SHEET NAME: SITE PLAN

DRAWING NUMBER: C200

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.



GRADING LEGEND:

75	PROPOSED MAJOR CONTOUR
76	PROPOSED MINOR CONTOUR
TC=78.01 BC=77.51	PROPOSED TOP OF CURB / BOTTOM OF CURB ELEVATION
TW/BW=152.50	PROPOSED TOP OF WALL / BOTTOM OF WALL
77.73	PROPOSED SPOT ELEVATION
EG=77.73	EXISTING ELEVATION
HP=77.73	PROPOSED HIGH POINT ELEVATION
TG=77.73	PROPOSED TOP OF GRATE ELEVATION
FF=77.73	FINISHED FLOOR ELEVATION
2.5%	PROPOSED SLOPE
72	EXISTING CONTOUR
	RIDGE LINE

GRADING NOTES

1. REFER TO EROSION AND SEDIMENT CONTROL PLAN FOR REQUIRED EROSION AND SEDIMENT CONTROL MEASURES.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND REMOVAL OF TEMPORARY SEDIMENTATION CONTROLS. EROSION CONTROL MEASURES SHALL NOT BE REMOVED BEFORE VEGETATION HAS OCCURRED COMPLETELY.
3. ALL SILT FENCE TO BE REPLACED WHENEVER THEY BECOME CLOGGED OR INOPERABLE AND SHALL BE REPLACED AT A MINIMUM OF EVERY 3 MONTHS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORATION OF TOPSOIL TO ALL DISTURBED AREAS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN EROSION CONTROL MEASURES AT ALL TIMES.
5. SILT FENCE, JUTE MESH, AND/OR EROSION CONTROL BLANKETS WILL BE USED ON STEEP SLOPES AND WHEREVER NECESSARY TO CONTROL EROSION AND SILTATION OF EXISTING DRAINAGE SYSTEMS AS ORDERED BY THE ENGINEER OR SPECIFIED ON PLANS.
6. THE CONTRACTOR SHALL DESIGNATE A MEMBER OF HIS/HER FIRM TO BE RESPONSIBLE TO MONITOR EROSION CONTROL, EROSION CONTROL STRUCTURES, TREE PROTECTION AND PRESERVATION THROUGHOUT CONSTRUCTION.
7. ALL DISTURBED AREAS SHALL BE PROTECTED FROM EROSION EITHER BY MULCH OR TEMPORARY SEEDING WITHIN 2 WEEKS OF DISTURBANCE.
8. ALL SITE GRADING MUST BE PERFORMED TO INSURE POSITIVE DRAINAGE ACROSS THE ENTIRE SITE, THROUGHOUT THE PERIOD OF CONSTRUCTION AND AFTER PROJECT COMPLETION.
9. ALL SEDIMENTATION AND SOIL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED PRIOR TO THE COMMENCEMENT OF SITE GRADING AND MUST CONFORM TO PART 91 OF ACT 451 OF THE PUBLIC ACTS OF 1994 AS AMENDED. ALL APPLICABLE PERMITS SHALL BE OBTAINED BEFORE IMPLEMENTING THESE MEASURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE SEDIMENTATION AND SOIL EROSION CONTROL MEASURES THROUGHOUT CONSTRUCTION.
10. IN GENERAL, EARTHWORK AND PAVEMENT CONSTRUCTION SHOULD BE PERFORMED IN ACCORDANCE WITHE THE LATEST MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION UNLESS OTHERWISE NOTED.
11. REMOVE ANY EXISTING TOPSOIL, ORGANIC SOILS, UNSUITABLE FILL, VEGETATION, TREES AN OTHER DELETERIOUS MATERIALS TO EXPOSE THE SUBGRADE SOIL, TREE ROOTS SHOULD BE COMPLETELY REMOVED.
12. EXCAVATE TO THE DEPTH OF THE FINAL SUBGRADE ELEVATION TO ALLOW FOR GRADE CHANGES AND THE PLACEMENT OF THE RECOMMENDED PAVEMENT SYSTEM.
13. ON SITE FILL MATERIAL CAN BE USED IF THE SPECIFIED COMPACTION REQUIREMENTS CAN BE ACHIEVED. IF ON SITE MATERIAL IS USED, IT SHOULD BE CLEAN AND FREE OF FROZEN SOIL, ORGANICS, OR OTHER DELETERIOUS MATERIALS.
14. THE FINAL SUBGRADE SHOULD BE THOROUGHLY PROOFROLLED USING A LOADED TANDEM AXLE TRUCK UNDER THE OBSERVATION OF GEOTECHNICAL/PAVEMENT ENGINEER. LOOSE OR YIELDING AREAS THAT CANNOT BE MECHANICALLY STABILIZED SHOULD BE REMOVED AND REPLACED WITH ENGINEERED FILL OR AS DICTATED BY FIELD CONDITIONS.
15. THE AGGREGATE BASE SHOULD BE COMPACTED TO ACHIEVE A MINIMUM OF 95 PERCENT OF THE MAXIMUM MODIFIED PROCTOR DRY DENSITY. THE BASE AND SUBGRADE COMPACTION SHOULD EXTEND A MINIMUM OF 12 INCHES BEYOND THE PAVED EDGE OR BACK OF CURB.

STORMWATER MANAGEMENT NARRATIVE

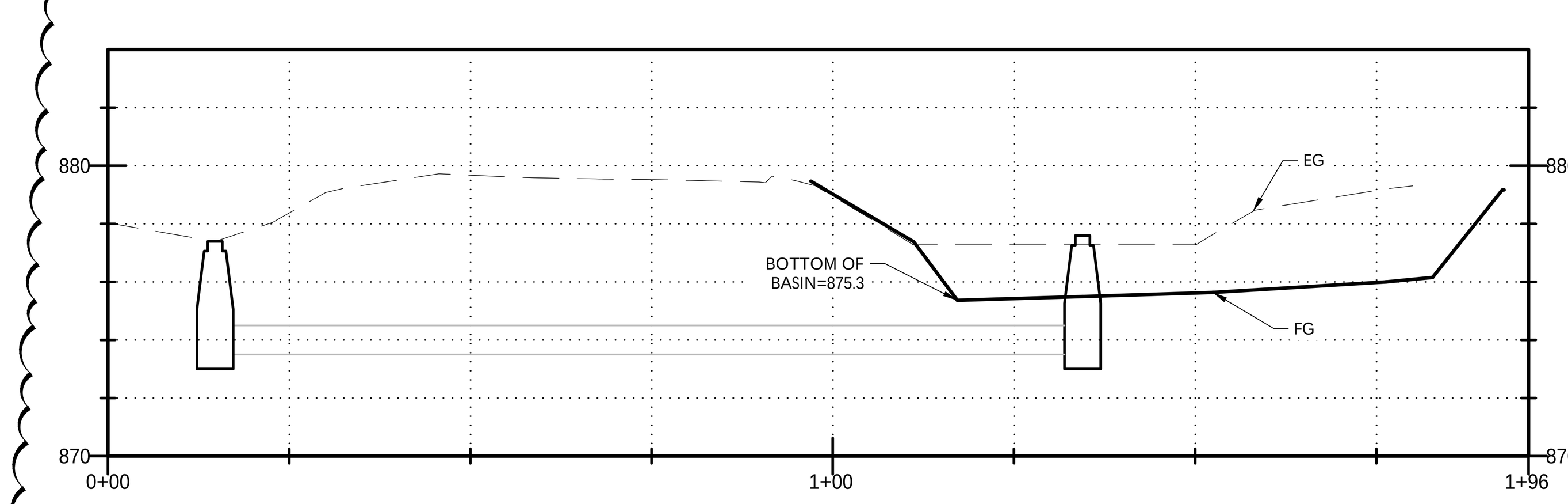
OWNER TO PERFORM MAINTENANCE ON EXISTING STORMWATER MANAGEMENT BASIN TO REMOVE 24" MIN SEDIMENT ACCUMULATION IN THE BOTTOM OF THE BASIN AND CLEANING OF THE EXISTING STORM SEWER SYSTEM TO REMOVE SEDIMENT A DEBRIS.

EXPAND EXISTING DETENTION BASIN TO PROVIDE STORAGE VOLUME OF THE 100-YEAR RAINFALL VOLUME FOR THE PROJECT AREA OF DISTURBANCE. USING AN ALLOWABLE RELEASE RATE EQUAL TO THE EXISTING CONDITIONS PEAK DISCHARGE FROM THE SITE (Q_{all} = 3.62 CFS) THE REQUIRED 100-YEAR. 24-HOUR STORAGE VOLUME IS 3,202 CUBIC FEET. SINCE THIS VOLUME IS LESS THATN THE BANK FULL FLOOD VOLUME GENERATED BY THE 2-YR 24-HOUR RAINFALL EVENT, THE PROPOSED STORAGE VOLUME WILL PROVIDE DETENTION OF THE BANK FULL FLOOD VOLUME.

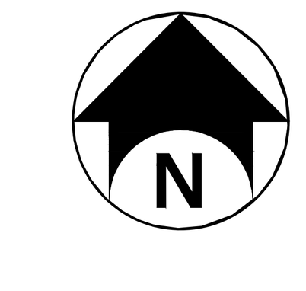
AREA OF DISTURBANCE:	1.67-AC.
POST DEVELOPED WEIGHTED 'C':	0.58
WATER QUALITY VOLUME:	2,946 CUBIC FEET @ ELEV 876.06
CHANNEL PROTECTION VOLUME:	7,922 CUBIC FEET @ ELEV 876.85
FLOOD STORAGE VOLUME:	8,509 CUBIC FEET @ ELEV 876.93

AN OUTLET CONTROL STRUCTURE WILL BE INSTALLED IN ACCORDANCE WITH DETAILS PROVIDED ON SHEET C700. OCS-1 WILL HAVE A 6" WIDE CONCRETE WEIR WALL INSTALLED IN THE FIELD TO PROVIDE LOW FLOW AND SECONDARY ORIFICE TO RESTRICT DISCHARGE FROM THE SITE.

EXISTING PIPE PROFILE



1" = 5' VERTICAL
1" = 20' HORIZONTAL



0 20 40 60 FT
1" = 20' SCALE BAR

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SCALE: AS SHOWN	DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA	REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025	PROJECT NUMBER: 25009299A

SHEET NAME:

GRADING & DRAINAGE PLAN

DRAWING NUMBER:

C300

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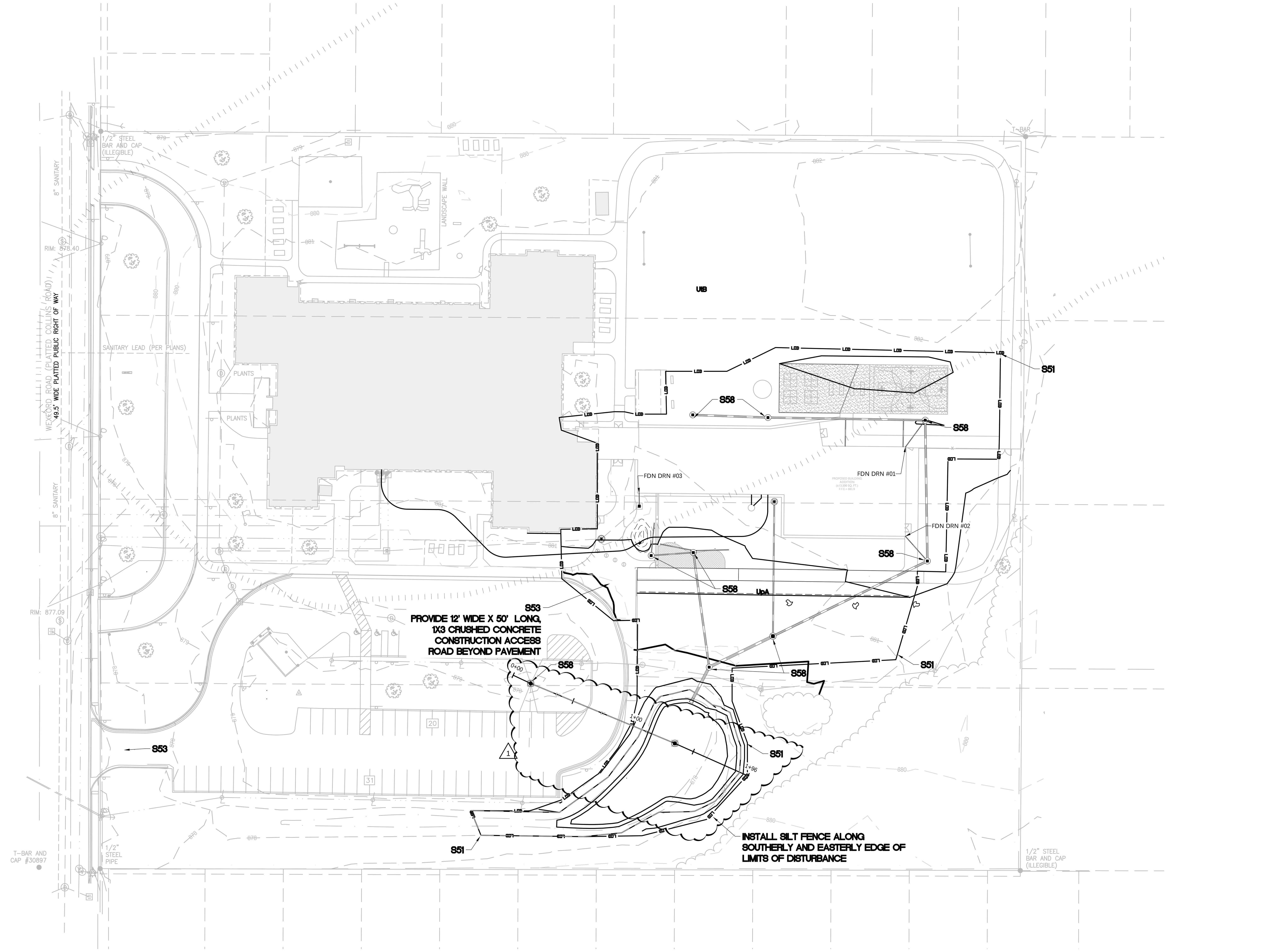

SESC NOTES:

1. CONTRACTOR IS TO CONTACT THE CITY OF LANSING OR INGHAM COUNTY DRAIN COMMISSIONERS OFFICE AT LEAST THREE (3) DAYS PRIOR TO THE START OF CONSTRUCTION.
2. CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING ALL SOIL EROSION CONTROL MEASURES DURING CONSTRUCTION. SESC MEASURES SHOULD BE CHECKED DAILY AND AFTER STORM EVENTS FOR EFFECTIVENESS. OWNER SHALL MAINTAIN ALL PERMANENT SESC MEASURES AFTER CONSTRUCTION IS COMPLETE. ALL SESC MEASURES SHALL BE CHECKED MONTHLY FOR ONE YEAR FOR EFFECTIVENESS. ANY MEASURES THAT HAVE FAILED SHALL BE REPAIRED AND/OR REPLACED.
3. ALL TEMPORARY S.E.C. MEASURES SHALL BE MAINTAINED 30 DAYS AFTER CONSTRUCTION IS COMPLETE OR UNTIL GRADED AREAS ARE STABILIZED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING TEMPORARY SESC MEASURES.
4. ALL GRADED AREAS EXPOSED FOR MORE THAN 20 DAYS SHALL HAVE STRAW MULCH APPLIED AT THE RATE OF 3 TONS / ACRE. AREAS NOT AT FINISHED GRADE AND WHICH WILL BE DISTURBED AGAIN WITHIN ONE YEAR MUST BE SEEDED AND MULCHED WITH QUICK GROWING TEMPORARY SEEDING MIXTURE AND MULCH. AREAS WHICH ARE AT FINISHED GRADE AND WILL NOT BE DISTURBED FOR A YEAR MUST BE SEEDED AND MULCHED WITH A PERMANENT SEED MIXTURE.
5. ONLY LIMITED DISTURBANCE WILL BE PERMITTED TO PROVIDE ACCESS TO THE SITE FOR GRADING AND TO CONSTRUCT SEDIMENT BASINS, SEDIMENT TRAPS, DIVERSION TERRACES, INTERCEPTOR CHANNELS, AND/OR CHANNELS OF CONVEYANCE AS APPROPRIATE.
6. EROSION AND SEDIMENTATION CONTROLS MUST BE CONSTRUCTED, STABILIZED, AND FUNCTIONAL BEFORE SITE DISTURBANCE WITH THE TRIBUTARY AREAS OF THOSE CONTROLS.
7. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENTATION MUST BE MAINTAINED PROPERLY. MAINTENANCE MUST INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENTATION CONTROL ON A DAILY BASIS AND AFTER EACH STORM EVENT. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING, AND RENETTING, MUST BE PERFORMED IMMEDIATELY.
8. CONTACT INFORMATION FOR THE ON-SITE EXCAVATING CONTRACTORS, HAULING CONTRACTORS, ETC., PERSON AND COMPANY, INCLUDING OFFICE, MOBILE AND FAX PHONE NUMBERS, SHALL BE SUBMITTED TO THE INGHAM COUNTY DRAIN COMMISSIONER'S OFFICE PRIOR TO COMMENCEMENT OF EARTH DISTURBANCE.
9. APPROVAL OF THE SOIL EROSION PERMIT DOES NOT AUTHORIZE ANY EARTH DISTURBANCE ACTIVITY OFF-SITE WITHOUT WRITTEN PERMISSION FOR THAT EARTH DISTURBANCE ACTIVITY FROM THE LANDOWNER.
10. NO DEWATERING IS PLANNED FOR THIS PROJECT. IF DEWATERING IS REQUIRED, THE CONTRACTOR SHALL SUBMIT A DEWATERING PLAN FOR APPROVAL TO THE INGHAM COUNTY DRAIN COMMISSIONER'S OFFICE AND/OR THE MDEQ AS REQUIRED. NO DEWATERING SHALL COMMENCE UNTIL APPROVAL HAS BEEN OBTAINED.

SESC LEGEND:

S53	REFERS TO THE APPROPRIATE M.D.M.B. S.E.S.C. KEYING SYSTEM DETAIL
SILT	SILT FENCE
LOD	LIMITS OF EARTH DISTURBANCE (±1.67 ACRES)
	SOIL BOUNDARY
	PROPOSED EROSION BLANKET W/ SEED

SOIL TYPES:

UpA	URBAN LAND CAPAC-COLWOOD COMPLEX, 0 TO 4 PERCENT SLOPES
UtB	URBAN LAND MARLETTE COMPLEX, 2 TO 12 PERCENT SLOPES

SEQUENCE OF CONSTRUCTION NOTES:

NOTE: THIS TEXT IS NOT INTENDED TO DICTATE A METHODS AND MEANS TO THE CONTRACTOR. IT IS THE SUGGESTED PROCESS FOR CONSTRUCTION ACTIVITIES IN ORDER TO MINIMIZE THE AMOUNT OF SOIL EROSION TO THE SITE AND TO COMPLY WITH THE REQUIREMENTS OF THE SOIL EROSION AND SEDIMENTATION CONTROL PERMIT. AS PART OF THE PERMIT CONDITIONS, THE CONTRACTOR WILL BE HELD TO THIS SCHEDULE AND TO THE SOIL EROSION PLAN. IF THE CONTRACTOR SEES FIT, HE OR SHE MAY AMEND THIS SCHEDULE AND/OR PLAN, BUT A REVISED WRITTEN SEQUENCING SCHEDULE AND/OR SOIL EROSION PLAN MUST BE SUBMITTED TO THE INGHAM COUNTY DRAIN COMMISSIONER FOR APPROVAL PRIOR TO DEVIATING TO THIS SCHEDULE AND/OR PLAN.

STEP 1: INSTALL TEMPORARY SOIL EROSION CONTROL MEASURES

STEP 2: ROUGH GRADING: STRIPPING AND STOCKPILING TOPSOIL. AREAS THAT WILL NOT BE FURTHER DISTURBED DURING THE COURSE OF CONSTRUCTION SHALL BE IMMEDIATELY SEEDED WITH MULCH. EXCESS MATERIAL SHALL EITHER BE STOCKPILED IN THE AREAS SHOWN ON THE DRAWINGS, LEVELED ON SITE, OR DISPOSED OF OFF-SITE IN A LEGAL MANNER. STOCKPILES SHALL BE TEMPORARILY STABILIZED WITH SILT FENCE AND/OR TEMPORARY SEEDING.

STEP 3: UNDERGROUND UTILITIES. EXCAVATED MATERIAL FOR UTILITIES SHALL EITHER BE STOCKPILED, LEVELED ON SITE, OR DISPOSED OF OFF-SITE IN A LEGAL MANNER.

STEP 4: BUILDING CONSTRUCTION

STEP 5: FINAL GRADING (1): AREAS OUTSIDE THE INFLUENCE OF FURTHER CONSTRUCTION ACTIVITIES SHALL BE FINAL GRADED AND STABILIZED WITH PERMANENT SEED AND MULCH.

STEP 6: PAVING.

STEP 7: FINAL GRADING (2): ALL REMAINING AREAS SHALL BE SEEDED AND MULCHED WITHIN 5 DAYS OF FINAL GRADING.

STEP 8: TEMPORARY SOIL EROSION CONTROL MEASURES ARE TO BE REMOVED WHEN PERMANENT MEASURES ARE IN PLACE AND THE AREA IS STABILIZED.

CONTINUED MAINTENANCE OF ALL PERMANENT SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE THE RESPONSIBILITY OF THE OWNER. MAINTENANCE RESPONSIBILITIES SHALL BECOME A PART OF ANY SALES OR EXCHANGE AGREEMENT FOR THE LAND ON WHICH THE PERMANENT SOIL EROSION AND SEDIMENTATION CONTROL MEASURES ARE LOCATED.

SESC KEYING SYSTEM

KEY	BEST MANAGEMENT PRACTICES	SYMBOL	WHERE USED
E5	DUST CONTROL		For use on construction sites, unpaved roads, etc. to reduce dust and sedimentation from wind and construction activities.
E6	MULCH		For use in areas subject to erosive surface flows or severe wind or on newly seeded areas.
E8	PERMANENT SEEDING		Stabilization method utilized on sites where earth change has been completed (final grading attained).
E9	MULCH BLANKETS		On exposed slopes, newly seeded areas, new ditch bottoms, or areas subject to erosion.
E12	RIPRAP		Use along shorelines, waterways, or where concentrated flows occur. Slows velocity, reduces sediment load, and reduces erosion.
S51	SILT FENCE		Use adjacent to critical areas, to prevent sediment laden sheet flow from entering these areas.
S53	STABILIZED CONSTRUCTION ACCESS		Used at every point where construction traffic enters or leaves a construction site.
S58	INLET PROTECTION FABRIC DROP		Use at stormwater inlets, especially at construction sites.

SOIL EROSION/SEDIMENTATION CONTROL OPERATION TIME SCHEDULE

	OCTOBER				NOVEMBER				DECEMBER				JANUARY				FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER			
CONSTRUCTION SEQUENCE	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
TEMPORARY CONSTRUCTION ENTRANCE									X																																							
TEMPORARY CONTROL MEASURES									X	X	X																																					
SITE DEMOLITION									X	X	X	X																																				
SEDIMENT CONTROL BASIN(S)/TRAP(S)																																																
STRIP & STOCKPILE TOPSOIL																																																
ROUGH GRADING																																																
STORM FACILITIES																	X	X	X	X	X																											
SITE CONSTRUCTION																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
FINISH GRADING																																		X	X	X	X											
PERMANENT CONTROL STRUCTURES																																				X	X	X	X	X	X							
LANDSCAPING/SEED/FINAL STABILIZATION																																								X	X	X	X					

PRELIMINARY SCHEDULE - TO BE CONFIRMED WITH OWNER AND CONSTRUCTION MANAGER PRIOR TO PERMITTING

N

0 40 80 120 FT
1" = 40' SCALE BAR

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SCALE: AS SHOWN
DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA
REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025
PROJECT NUMBER: 25009299A

SHEET NAME: SESC PLAN

DRAWING NUMBER: C301

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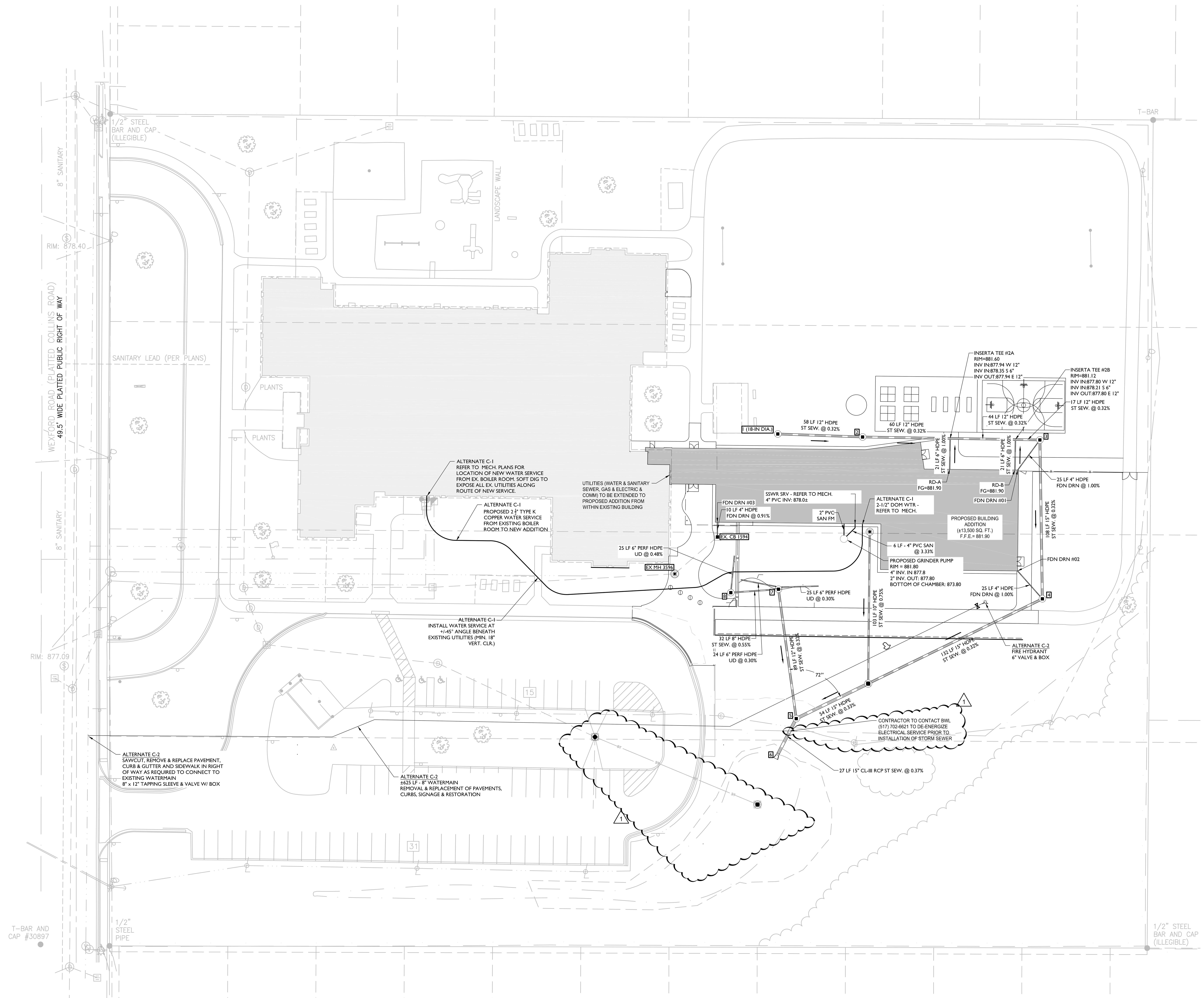

UTILITY NOTES:

1. ALL WORKMANSHIP, MATERIALS, AND CONSTRUCTION PRACTICES SHALL CONFORM TO THE REQUIREMENTS OF DELTA TOWNSHIP OR THE AGENCY HAVING JURISDICTION OVER THE APPLICABLE UTILITY.
2. CONTRACTOR IS RESPONSIBLE FOR REPAIRS OF DAMAGE TO ANY EXISTING UTILITY DURING CONSTRUCTION AT NO COST TO THE OWNER.
3. ALL FILL MATERIAL IS TO BE IN PLACE, AND COMPACTED BEFORE INSTALLATION OF PROPOSED UTILITIES.
4. CONTRACTOR SHALL NOTIFY THE UTILITY COMPANIES 72 HOURS BEFORE CONNECTING TO ANY EXISTING LINE.
5. IN THE EVENT OF A VERTICAL CONFLICT BETWEEN WATERLINES, SANITARY LINES, STORM LINES AND GAS LINES (EXISTING AND PROPOSED), THE CONTRACTOR SHALL NOTIFY THE ENGINEER AS SOON AS THE CONFLICT IS DISCOVERED.
6. TOPS OF EXISTING UTILITY STRUCTURES SHALL BE ADJUSTED TO FINISHED GRADE.
7. EXISTING UTILITIES SHALL BE VERIFIED IN FIELD PRIOR TO INSTALLATION OF ANY NEW LINES.
8. CONTRACTOR IS RESPONSIBLE FOR COMPLYING TO THE CONSTRUCTION REQUIREMENTS OF THE UTILITY OWNERS.
9. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
10. CONTRACTOR SHALL COORDINATE WITH ALL UTILITY COMPANIES FOR INSTALLATION REQUIREMENTS AND SPECIFICATIONS.
11. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS AND SPECIFICATIONS FOR ACTUAL LOCATION AND ELEVATIONS OF ALL UTILITY ENTRANCES TO INCLUDE SANITARY SEWER LATERALS, DOMESTIC AND FIRE PROTECTION WATER SERVICE, ELECTRICAL, TELEPHONE, AND GAS SERVICE. CONTRACTOR SHALL COORDINATE INSTALLATION OF UTILITIES, IN SUCH A MANNER AS TO AVOID CONFLICTS AND ASSURE PROPER DEPTHS ARE ACHIEVED AS WELL. AS COORDINATING WITH UTILITY REQUIREMENTS AS TO LOCATION AND SCHEDULING FOR TIE-INS/CONNECTIONS PRIOR TO CONNECTING TO EXISTING UTILITIES.
12. THE CONTRACTOR SHALL CONDUCT ALL REQUIRED TESTS TO THE SATISFACTION OF THE RESPECTIVE UTILITY COMPANIES AND THE OWNER'S INSPECTING AUTHORITIES.
13. CONTRACTOR SHALL COMPLY TO THE FULLEST EXTENT WITH THE LATEST STANDARDS OF OSHA DIRECTIVES OR ANY OTHER AGENCY HAVING JURISDICTION FOR EXCAVATION AND TRENCHING PROCEDURES. THE CONTRACTOR SHALL USE SUPPORT SYSTEMS, SLOPING, BENCHING, AND OTHER MEANS OF PROTECTION. THIS TO INCLUDE BUT NOT LIMITED FOR ACCESS AND EGRESS FROM ALL EXCAVATION AND TRENCHING. CONTRACTOR IS RESPONSIBLE TO COMPLY WITH PERFORMANCE CRITERIA FOR OSHA.
14. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING PIPE SIZES AND INVERTS ELEVATIONS BEFORE ORDERING MANHOLE AND CATCH BASIN STRUCTURES.
15. ALL UTILITIES BELOW PAVED AREAS SHALL BE BACKFILLED WITH 100% GRANULAR MATERIAL (OR APPROVED OTHER) AND COMPACTED TO 95% OF ITS MAXIMUM UNIT WEIGHT.
16. ALL RIM ELEVATIONS IN OUTLAWN AREAS ARE APPROXIMATE ONLY AND SHALL BE ADJUSTED BY THE CONTRACTOR AFTER FINAL GRADES ARE ESTABLISHED.

UTILITY LEGEND:

- RIPRAP
- STORM SEWER
- YARD BASIN
- CATCH BASIN
- STORM MANHOLE
- HYDRANT
- VALVE/CURB BOX
- P.I.V.
- WATER MAIN
- SANITARY SEWER
- SANITARY SEWER MANHOLE
- CLEANOUT
- ELECTRIC
- GAS
- UTILITY CROSSING

SANITARY SEWER - BASE BID:

1. BASE BID TO INCLUDE INSTALLATION OF A 30" DIA. SIMPLEX GRINDER PUMP PACKAGE, LIBERTY PUMPS, MODEL 3096 LSGX HAVING A 2hp, 208-230 v PUMP, gr20 GUIDE RAIL SYSTEM AND SIMPLEX CONTROL PANEL WITH ALARM,), THE BASIN SHALL BE DELIVERED WITH A 4" PVC SANITARY SEWER INLET AND A 2" PVC FORCEMAIN AT A DEPTH 4 FEET BELOW RIM ELEVATOIN. PRESSURE SEWER FROM THE GRINDER PUMP BACK TO AND THROUGH THE BUILDING SHALL BE AS CALLED FOR ON MECHANICAL/PLUMBING PLANS.
2. CONTROL PANEL TO BE CONNECTED TO THE BUILDING MANAGEMENT SYSTEM. CONTRACTOR TO ENSURE LOCATION OF CONTROL PANEL CAN BE CONNECTED TO BMS WIHTOUT LOSS OF FREQUENCY OR SIGNAL STRENGTH.
3. COORDINATE WITH ARCHITECTURAL AND ELECTRICAL PLANS FOR LOCATION OF CONTROL PANEL

WATER SUPPLY - BASE BID:

1. BASE BID TO INCLUDE IINSTALLATION OF WATER SERVICE FROM EXISTING BOILER ROOM TO PROPOSED BUILDING ADDITION THROUGH THE CEILING WITHIN THE BUILDING AND THE CEILING OF THE BUILDING ADDITION AS DEFINED ON THE ARCHITECTURAL, MECHANICAL & PLUMBING PLANS.

ALTERNATE C-1:

1. ALTERNATE C-1 TO INCLUDE INSTALLATION OF WATER SERVICE FROM EXISTING BOILER ROOM TO PROPOSED BUILDING ADDITION AS SHOWN HEREON AS WELL AS ON THE MECHANICAL PLANS.

ALTERNATE C-2:

1. ALTERNATE C-2 TO INCLUDE CONNECTION TO THE EXISTING WATERMAIN IN WEXFORD AVENUE WITH A TAPPING SLEEVE & VALVE, INSTALLATION OF NEW 8" WATERMAIN, BENDS & FITTINGS AS NECESSARY TO DELIVER A PUBLIC WATERMAIN EXTENSION AS REQUIRED BY THE CITY OF LANSING TO THE NEW HYDRANT NEAR THE SE CORNER OF THE PROPOSED BUILDING ADDITION. PRICING FOR THIS ALTERNATE SHALL INCLUDE SAWCUTTING, REMOVAL AND REPLACEMENT OF CONCRETE CURBS & GUTTERS, WALKS, AND PAVEMENTS WITHIN 7.5' OF EITHER SIDE OF THE 8" WATERMAIN SHOWN, AS WELL AS PROTECTION OF ALL EXISTING BURIED UTILITIES, SITE LIGHTING, DUMPSTER ENCLOSURE ETC... AND RESTORATION OF ALL LAWN AND LANDSCAPED AREAS DISTURBED DURING THE TRENCHING AND INSTALLATION OF THE NEW CL-53 DUCTILE IRON WATERMAIN & FITTINGS.

1" = 30' SCALE BAR

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	11/07/25	ISSUE FOR BIDS
1	12/05/25	ADDENDUM 02

Lansing School District

CLASSROOM & GYM ADDITIONS FOR

WEXFORD MONTESSORI ACADEMY

5217 WEXFORD RD
INGHAM COUNTY
LANSING MI 48911

NOT FOR CONSTRUCTION

Colliers Engineering & Design
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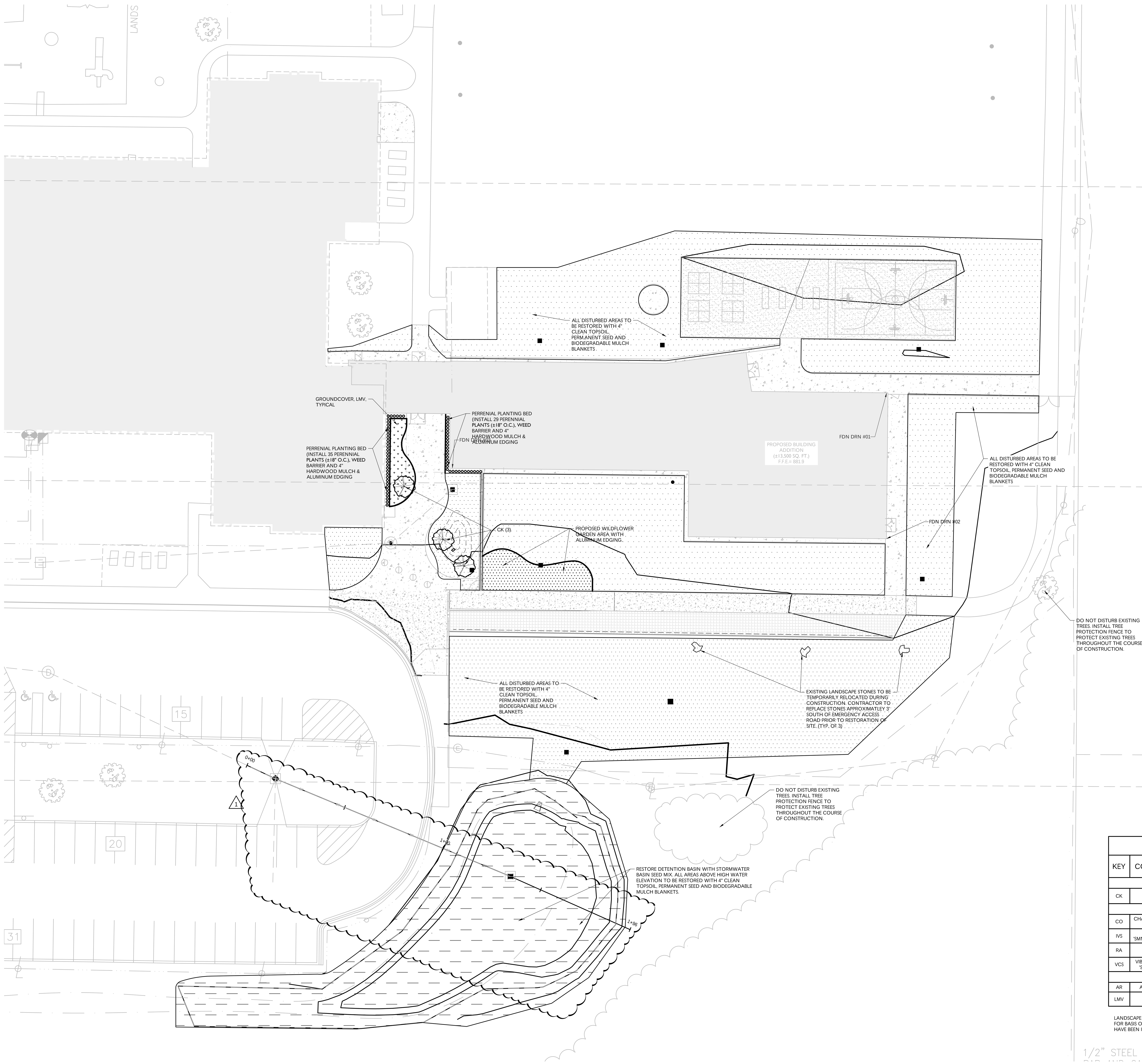
COLLIERS ENGINEERING & DESIGN, ARCHITECTURE, LANDSCAPE ARCHITECTURE, SURVEYING CT, P.C.

SCALE: AS SHOWN	DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA	REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025	PROJECT NUMBER: 25009299A

SHEET NAME:
UTILITY PLAN

DRAWING NUMBER:
C400

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.



LANDSCAPING NOTES:

1. ALL PLANTS MUST BE HEALTHY, VIGOROUS, AND FREE OF PESTS AND DISEASE.
2. STANDARDS SET FORTH IN AMERICAN STANDARD FOR NURSERY STOCK, ANSI, Z60.1 (LATEST EDITION), REPRESENT GUIDELINE SPECIFICATIONS ONLY AND SHALL CONSTITUTE MINIMUM QUALITY REQUIREMENTS FOR PLANT MATERIAL.
3. ALL PLANTS MUST BE HARDY UNDER CLIMATE CONDITIONS THAT EXIST AT THE PROJECT SITE AND GROWN AT A NURSERY AT THE SAME HARDINESS ZONE AS THE PROJECT LOCATION.
4. NO SUBSTITUTIONS SHALL BE PERMITTED WITHOUT PRIOR WRITTEN APPROVAL OF THE OWNER OR OWNER'S REPRESENTATIVE.
5. ALL TREES MUST BE STRAIGHT TRUNKED, INJURY FREE, AND FULL HEADED.
6. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL QUANTITIES SHOWN ON THESE PLANS BEFORE PRICING THE WORK.
7. ANY DISCREPANCY WITH QUANTITIES, LOCATIONS AND / OR FIELD CONDITIONS SHALL BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
8. MULCH ALL ISLANDS AND PLANTINGS IN LAWN AREAS WITH SHREDDED HARDWOOD MULCH TO A MINIMUM DEPTH OF THREE (3) INCHES UNLESS OTHERWISE DIRECTED.
9. ANY PLANT WHICH DIES, TURNS BROWN, OR DEFOLIATES (PRIOR TO TOTAL ACCEPTANCE OF THE WORK) SHALL BE PROMPTLY REMOVED FROM THE SITE AND REPLACED WITH MATERIAL OF THE SAME SPECIES, QUANTITY AND SIZE MEETING ALL PLANT LIST SPECIFICATIONS.
10. THE CONTRACTOR IS RESPONSIBLE FOR FULLY MAINTAINING ALL PLANT MATERIALS (INCLUDING, BUT NOT LIMITED TO: WATERING, SPRAYING, MULCHING, FERTILIZING, AND REMOVAL OF STAKES AND GUYS) AND LAWN AREAS UNTIL FINAL ACCEPTANCE BY THE OWNER.
11. THE CONTRACTOR SHALL INCLUDE A 1-YEAR MAINTENANCE AGREEMENT THAT IS TO INCLUDE ROUTINE WATERING, WEEDING, APPLICATION OF WEED PREVENTION AND SEASONAL FERTILIZER AND COMPLETELY GUARANTEE ALL PLANT MATERIAL FOR A PERIOD OF ONE (1) YEAR, BEGINNING ON THE DATE OF FINAL ACCEPTANCE. THE CONTRACTOR SHALL PROMPTLY MAKE ALL REPLACEMENTS BEFORE THE END OF THE GUARANTEE PERIOD. ANY PLANTINGS THAT ARE REPLACED DURING THE 1-YEAR WARRANTY PERIOD WILL START A NEW 1-YEAR WARRANTY FOR THE REPLACED ITEMS.
12. ALL AREAS DISTURBED BY UTILITY INSTALLATION AND SITE GRADING ACTIVITY SHALL RECEIVE APPROVED TOPSOIL (TO A COMPACTED DEPTH OF FOUR (4) INCHES, UNLESS OTHERWISE SPECIFIED BY THE GOVERNING MUNICIPALITY), BE FINE GRADED, SEEDED, MULCHED AND WATERED UNTIL A HEALTHY STAND OF GRASS IS OBTAINED.
13. ALL TOPSOIL SHALL BE SCREENED LOAM SURFACE SOIL, FREE OF STONES AND SHALL HAVE THE FOLLOWING MINIMUM REQUIREMENTS:
    a) AN ORGANIC CONTENT OF 6-12%
    b) SOIL ACIDITY RANGE OF pH 6.0 TO pH 6.8
    c) SOLUBLE SALTS OF 1000 PPM OR LESS
    d) MAXIMUM CLAY CONTENT OF 15-20%
14. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING, AT THEIR EXPENSE, A CERTIFIED SOIL TEST ANALYSIS OF ON SITE AND / OR IMPORTED TOPSOIL. TOPSOIL ANALYSIS TO INCLUDE THE FOLLOWING DATA:
    a) pH FACTOR.
    b) MECHANICAL ANALYSIS, INCLUDING SIEVE ANALYSIS PROVIDING SEPARATE SAND, SILT AND CLAY PERCENTAGES.
    c) PERCENTAGE OF ORGANIC CONTENT BY WEIGHT
    d) NUTRIENT LEVELS INCLUDING NITROGEN, PHOSPHOROUS AND POTASSIUM.
15. SHOULD TESTS AND ANALYSIS INDICATE THAT SOIL PROPOSED FOR USE IS DEFICIENT IN ANY OF THE ABOVE REQUIREMENTS; A SYSTEM OF AMELIORATING MAY BE PROPOSED FOR APPROVAL. ANY SYSTEM PROPOSED SHALL PROVIDE FOR AN ACIDITY RANGE OF Ph 6.0 TO 6.8 INCLUSIVE.
16. COMPOST SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS:
    a) ORGANIC CONTENT OF 35-60% (DRY WEIGHT BASIS)
    b) LOOSE AND FRIABLE WITH MOISTURE CONTENT OF 35-60% (WET WEIGHT BASIS)
    c) PARTICLE SIZE SHALL BE <1/2 INCH (100% PASSING)
    d) SOLUBLE SALTS CONCENTRATION SHALL BE <4.0 MMHOS/CM (DS/M), MAXIMUM
    e) pH RANGE OF 6.0-8.5
17. PLANTING MIX FOR PLANT PITS SHALL BE COMPOSED OF 2 PARTS IMPORTED OR ON-SITE SCREENED TOPSOIL AND 1 PART COMPOST. THE RATIO OF TOPSOIL TO COMPOST IS SUBJECT TO CHANGE BASED ON THE TESTING RESULTS FOR TOPSOIL.
18. LOCATIONS OF EXISTING BURIED UTILITIES SHOWN ON THE PLAN ARE BASED UPON BEST AVAILABLE INFORMATION AND ARE TO BE CONSIDERED APPROXIMATE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATIONS OF ALL UNDERGROUND UTILITY LINES ADJACENT TO THE WORK AREA. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY AND ALL DAMAGE TO UTILITIES, STRUCTURES AND SITE APPURTENANCES, ETC., WHICH OCCURS AS A RESULT OF THE LANDSCAPE INSTALLATION.
19. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL PLANT MATERIAL PER DETAILS. ANY DEVIATIONS FROM THE DETAIL MUST BE APPROVED BY THE OWNER'S REPRESENTATIVE OR LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
20. UPON FINAL ACCEPTANCE OF THE LANDSCAPE INSTALLATION, THE OWNER WILL ASSUME MAINTENANCE OF THE LANDSCAPED AREAS.
21. EXISTING TREES TO REMAIN SHALL BE PROTECTED BY INSTALLING A TEMPORARY FENCE AT THE OUTER LIMITS OF THE TREE CANOPY.

LANDSCAPING LEGEND:

SHADE TREE
FLOWERING TREE
EVERGREEN TREE
SHRUB

LANDSCAPE PLANT LIST						
KEY	COMMON NAME	BOTANICAL NAME	MATURE HIGHT	MATURE SPREAD	INSTALLED SIZE	CONDITION
ORNAMENTAL TREE						
CK	QUERCUS X WAREI '[NADLER PP17,604	KINDRED SPIRIT OAK	30' HT	6' SPREAD	8 - 10 FT.	B&B
DECIDUOUS/EVERGREEN SHRUBS						
CO	CHAMAECYPARIS OBTUSA 'COMPACTA'	EUONYMUS ALATUS 'PIPZAM'	6-8' HT	4-6' SPRD	24" - 30" HT	CONT
IVS	ITEA VIRGINIACA 'SMNIVDFC' SCENTLANDIA	JUNIPERUS H. 'PLUMOSA COMPACTA YOUNGSTOWN'	2-3' HT	2-3' SPRD	24" - 30" HT	CONT
RA	RHUS AROMATICA 'GRO-LOW'	MYRICA PENSYLVANICA	1.5-2' HT	6-8' SPRD	NO. 5 (30" SPRD)	CONT
VCS	VIBURNUM CASSINOIDES 'SMNVCDD' LIL DITTY		1-2' HT	1-2' SPRD	18" HT.	CONT
PERENNIALS / GROUNDCOVERS						
AR	ASTILBE 'RHEINLAND'	RHEINLAND ASTILBE	1.5-2' HT	1.5-2' SPRD	NO. 1	CONT
LMV	LIRIPOE MUSCARI 'VARIEGATA'	VAIRIEGATED LILY TURF	1.5-2' HT	1.5-2' SPRD	NO. 1	CONT

LANDSCAPE PLANTINGS PROVIDED ABOVE HAVE BEEN INSTALLED AT OTHER LANSING SCHOOL SITES. CONTRACTOR TO UTILIZE THIS LIST AND QUANTITIES PROVIDED FOR BASIS OF PRICING AND AND NEGOTIATION WITH LANDSCAPE CONTRACTOR TO PROVIDE AN AESTHETICALLY CONSISTENT PLANTING WITH VARIETIES THAT HAVE BEEN INSTALLED AT OTHER LOCAL SCHOOLS.

N

0 20 40 60 FT
1" = 20' SCALE BAR

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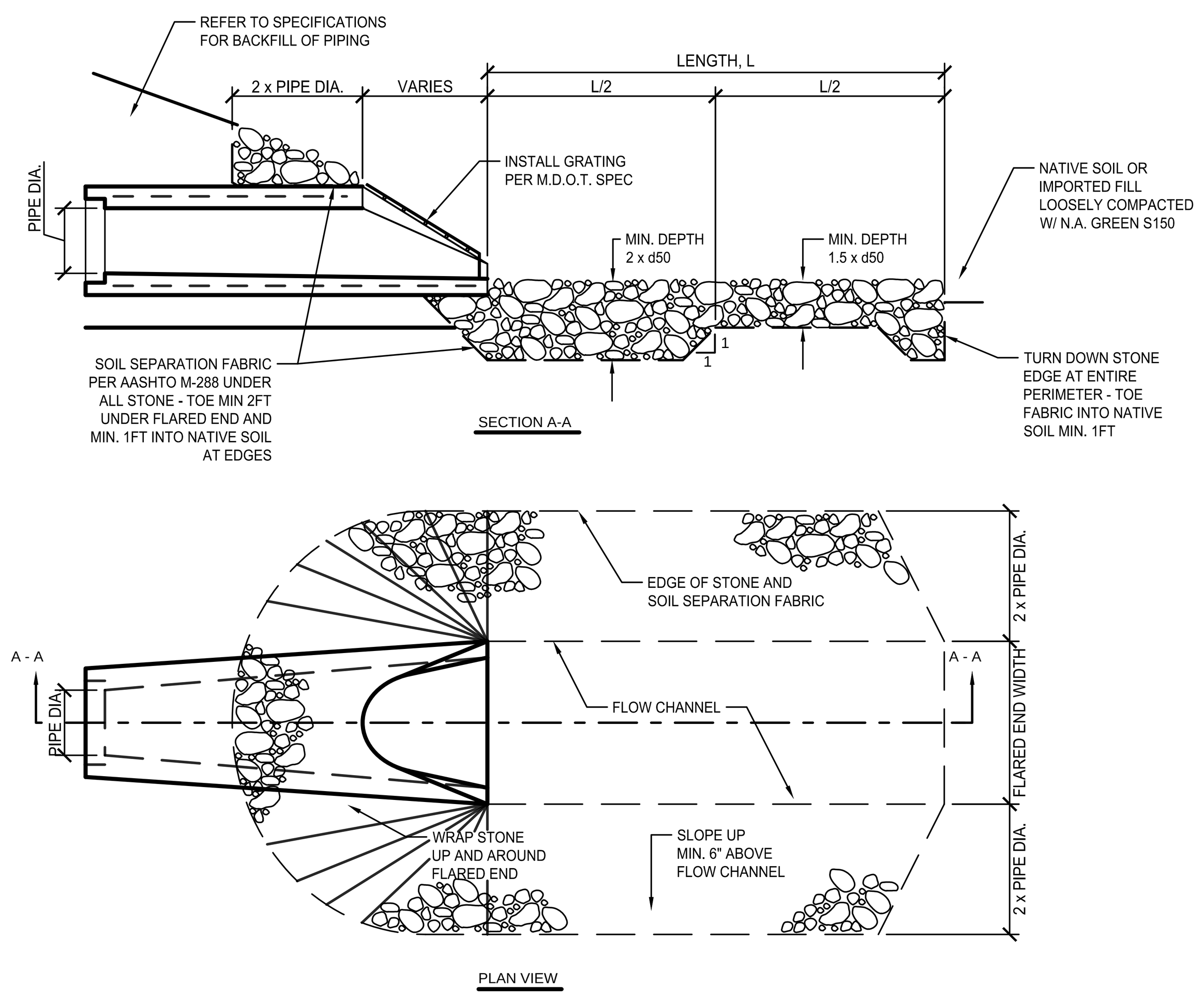
SCALE: AS SHOWN
DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA
REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025
PROJECT NUMBER: 25009299A

SHEET NAME: LANDSCAPE PLAN

DRAWING NUMBER: C600

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.

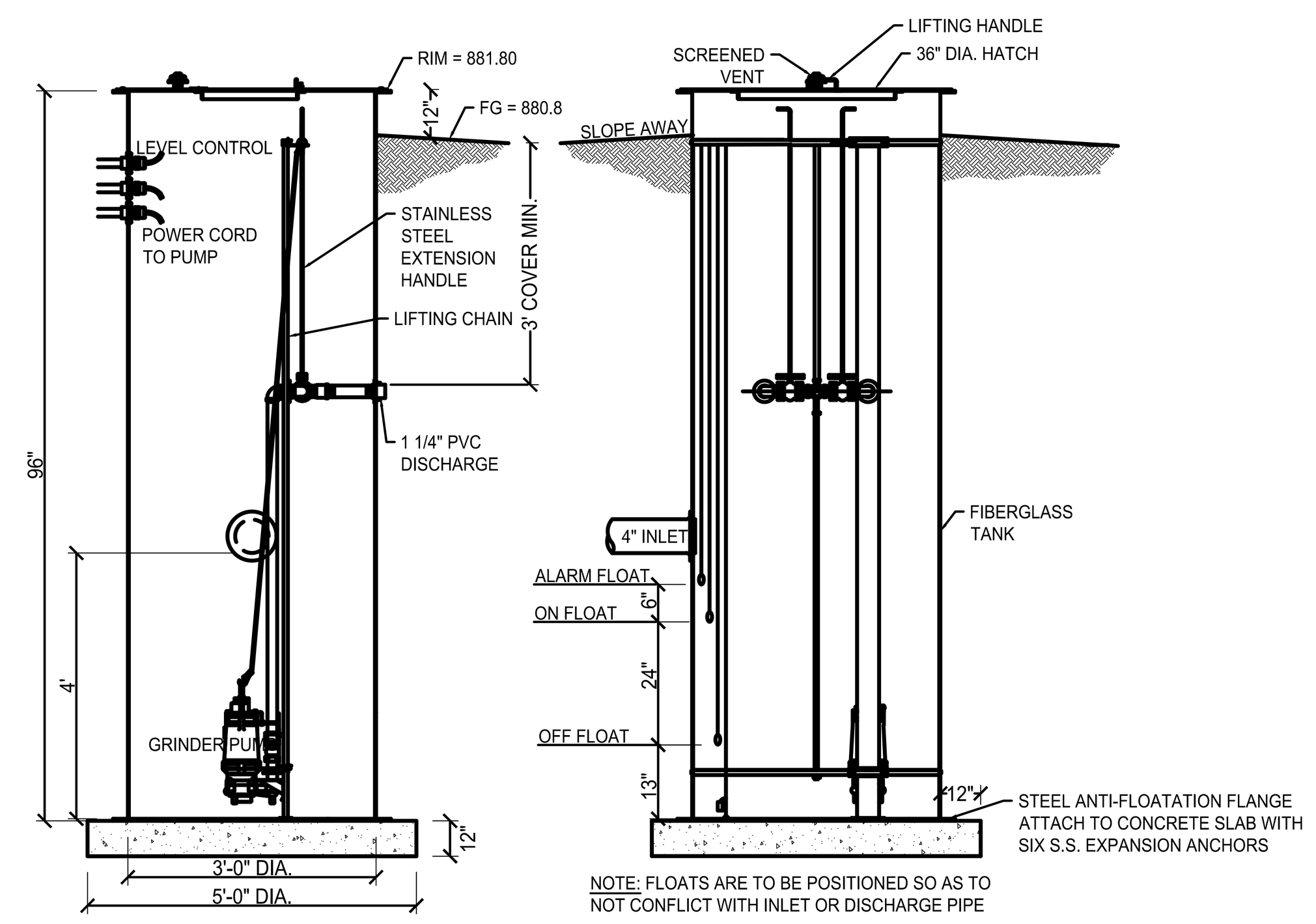


STONE OUTFALL SIZE REQUIREMENTS			
PIPE DIA.	MEDIAN SIZE, d50	LENTGH, L	MIN. QUANTITY
12"	9"	6FT	4CY
15"	9"	8FT	5CY
18"	9"	10FT	6CY
24"	12"	12FT	7CY

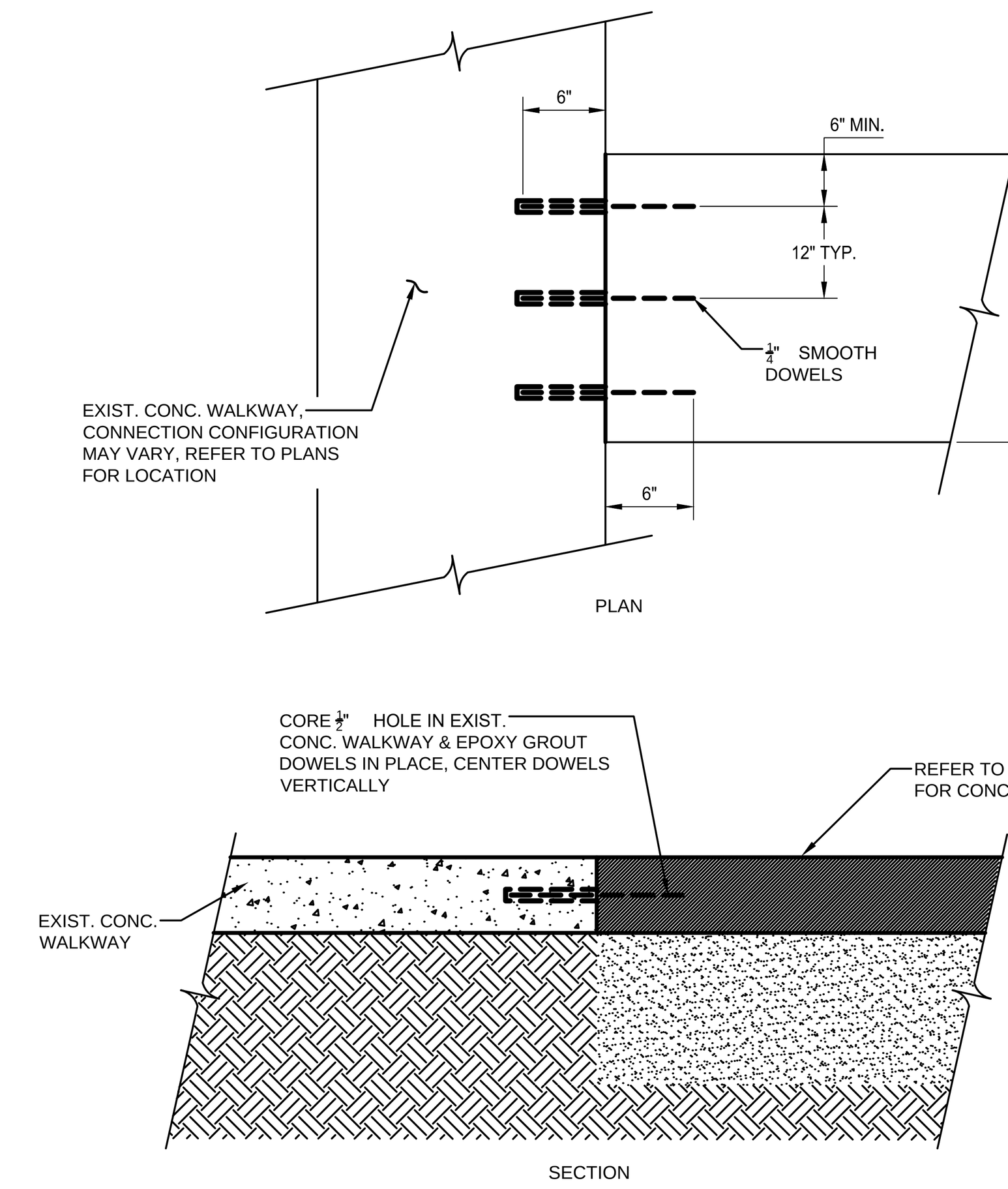
MEDIAN SIZE, d50	STONE GRADATION 3"	4"	9"	12"	15"	18"	21"
9"	2-10%		35-50%	50-70%	70-100%		
12"		2-10%		35-50%		50-70%	70-100%

GENERAL NOTES:
1. CONTRACTOR SHALL PROVIDE ENIGINEER GRADATION REPORT FOR STONE PLACED AT ALL OUTFALLS.
2. STONE SIZE SPECIFIED ON THIS DETAIL SUPERSEDES RIP RAP DETAILS IN SPECIFICATION 31 25 00.
3. STONE SHALL BE NATURAL, NON-STRATIFIED, DURABLE ROCK FREE FROM SOIL, HMA OR DEBRIS OF ANY KIND.
4. CONTRACTOR SHALL PLACE ALL STONE ON SOIL SEPERATION FABRIC MEETING OR EXCEEDING AASHTO M-288. ALL FABRIC MUST BE TOED MIN. 1FT INTO SURROUNDING GRADE AND MUST HAVE MIN. 2FT OVERLAP IF MULTIPLE LENGTHS OF FABRIC ARE REQUIRED.
5. IT MAY BE NECESSARY FOR CONTRACTOR TO PERFORM SOME HAND PLACEMENT OF THE ROCK ONCE PLACED IN LOCATION SPECIFIED ON PLAN. STONE SHALL BE SPREAD EVENLY OVER BLANKET.
6. CONCRETE FLARED END SHALL BE ASTM C-76 CLASS II.
7. PROVIDE STEEL GRATE FOR END SECTION PER MDOT STAND. SPECS.

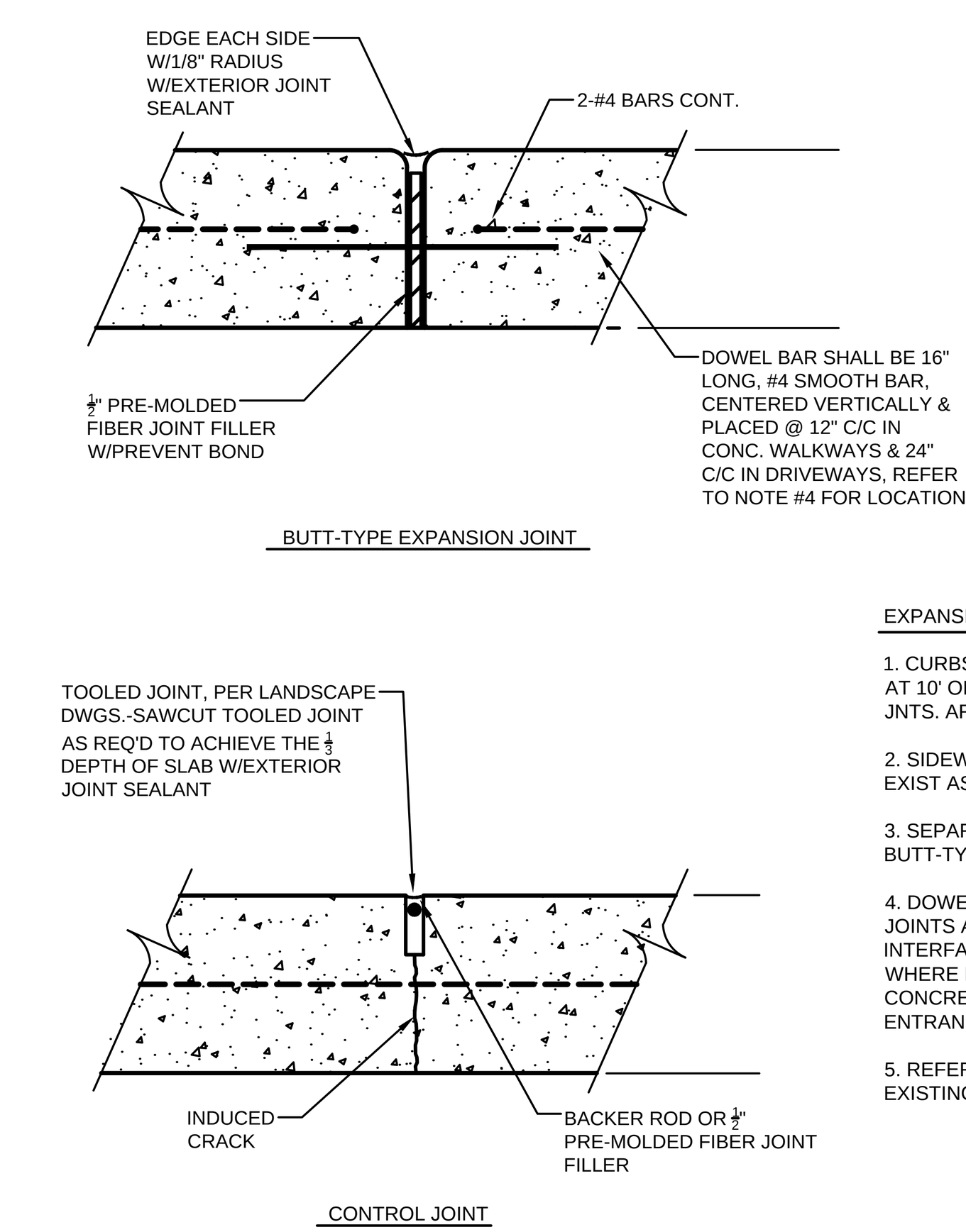
STONE OUTFALL DETAIL
N.T.S.



SIMPLEX GRIDER PUMP STATION
N.T.S.



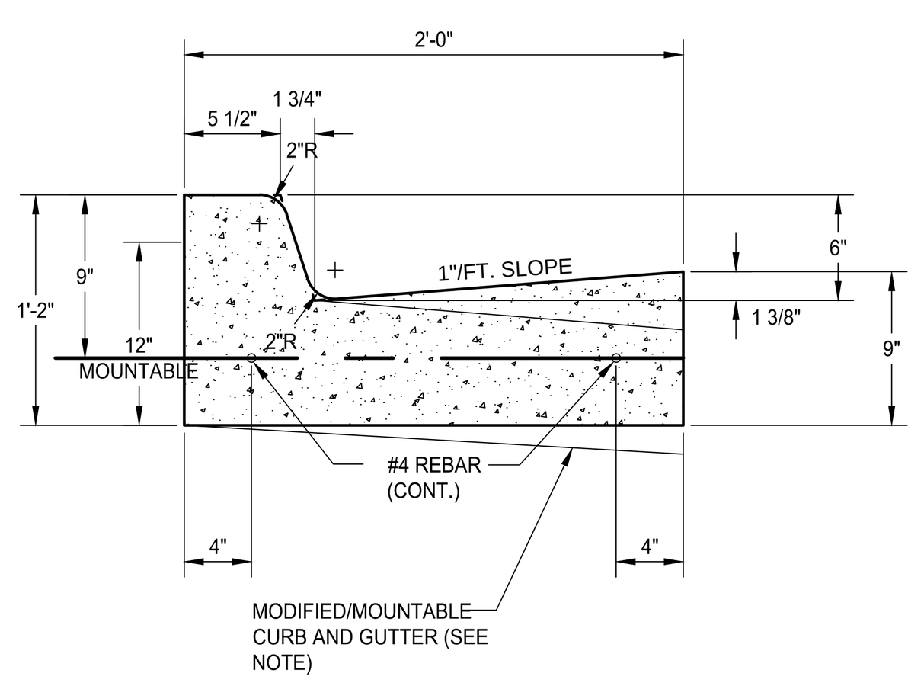
CONCRETE WALKWAY CONNECTION
N.T.S.



EXPANSION/CONTROL JOINT NOTES

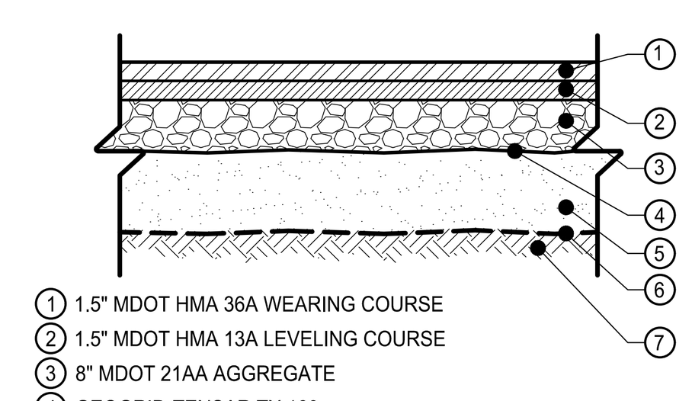
1. CURBS SHALL BE SAWCUT OR TOOLED AT 10' ON-CENTER, EXCEPT WHERE EXP. JNTS. ARE REQ'D.
2. SIDEWALK & PAVEMENT JOINTS SHALL EXIST AS SHOWN ON LANDSCAPE DWGS.
3. SEPARATE CONCRETE POURS WILL REQUIRE BUTT-TYPE EXPANSION JOINTS.
4. DOWELS ARE TO BE PLACED IN EXPANSION JOINTS AT BUILDING & CONCRETE STOOPS INTERFACE REFER TO ARCH. DETAILS & WHERE HEAVY DUTY SIDEWALKS ABOUT TO CONCRETE VALLEY GUTTERS AT DRIVEWAY ENTRANCES.
5. REFER TO DETAIL C35 FOR DOWELS INTO EXISTING CONCRETE SIDEWALKS.

EXPANSION AND CONTROL JOINTS
N.T.S.



NOTE:
MODIFIED/MOUNTABLE CURB AND GUTTER SHALL BE THE SAME DETAIL BUT THE GUTTER SHALL SLOPE AWAY FROM THE CURB FACE @ 1"/FT.

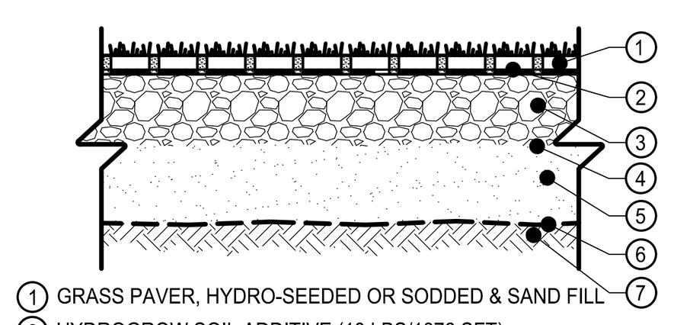
M.D.O.T F-4 CURB & GUTTER
N.T.S.



1. 1.5" MDOT HMA 36A WEARING COURSE
2. 1.5" MDOT HMA 13A LEVELING COURSE
3. 8" MDOT 21AA AGGREGATE
4. GEOGRID-TENSAR TX 160
5. 12" MDOT CLASS II SAND
6. NON-WOVEN GEOTEXTILE, STABILIZATION
7. COMPACTED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.

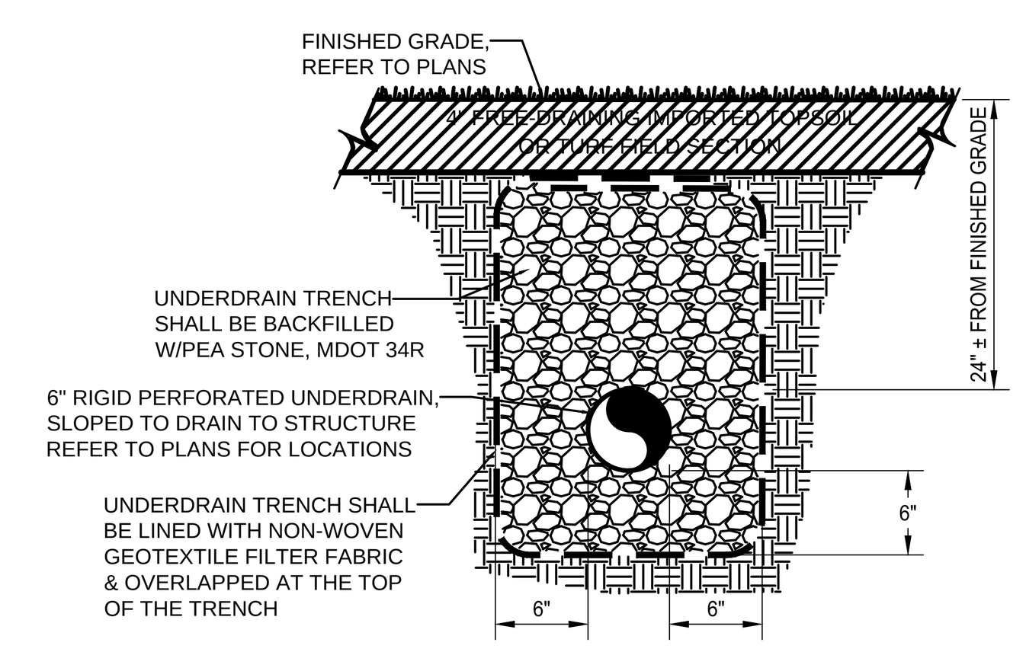
LIGHT DUTY ASPHALT PAVEMENT (RECORD DRAWING)
N.T.S.



1. GRASS PAVER, HYDRO-SEEDED OR SODDED & SAND FILL
2. HYDROGROW SOIL ADDITIVE (10 LBS/1076 SFT)
3. 6" 21AA AGGREGATE BASE COURSE
4. GEOGRID TENSAR BX 1200, AS REQUIRED BY GEOTECHNICAL
5. 6" MDOT CLASS II SAND
6. NON-WOVEN GEOTEXTILE, STABILIZATION, AS REQUIRED BY GEOTECHNICAL
7. COMPACTED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.
3. PROVIDE PERFORATED U.D. IN ACCORDANCE WITH STORM SYSTEM UNDERDRAIN SECTION IF REQUIRED BY ON-SITE GEOTECHNICAL ENGINEER. CONNECT TO STORM SEWER USING INSERTA-TEE WHERE APPROPRIATE.

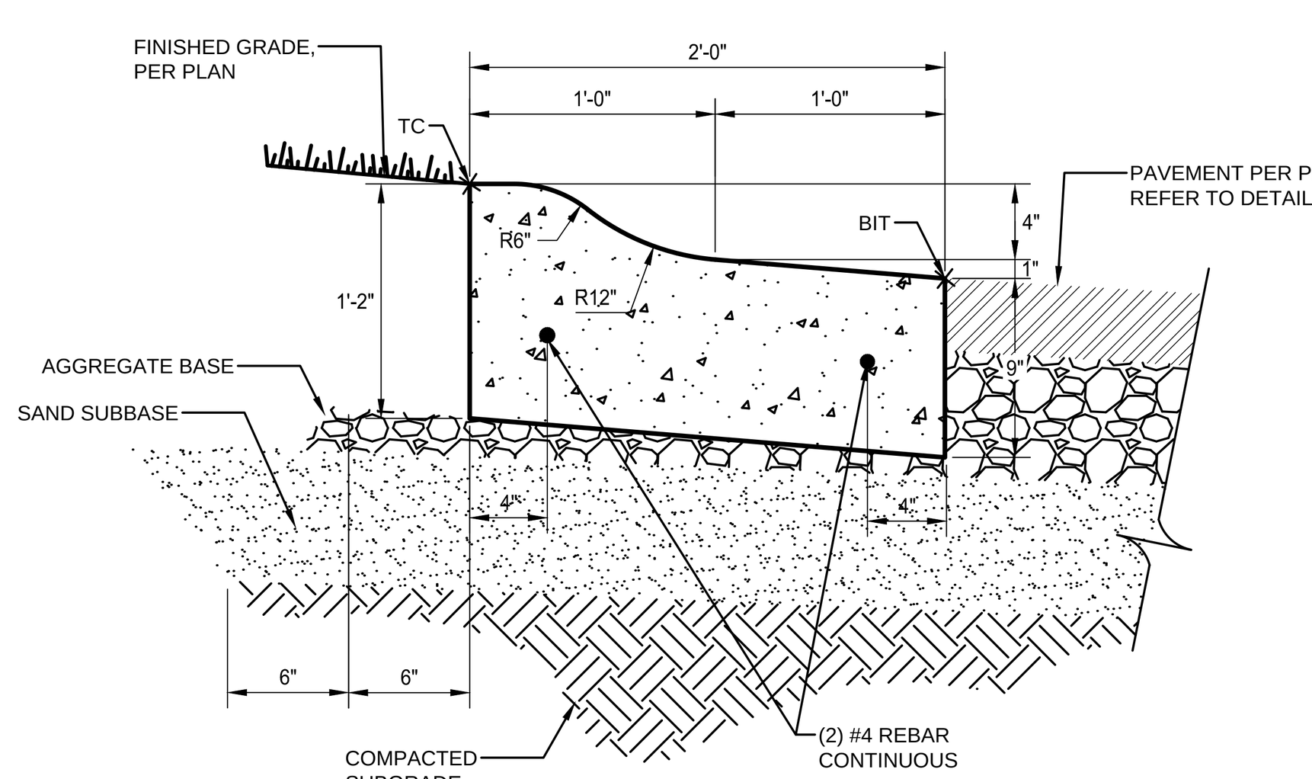
GRASS PAVER DETAIL
N.T.S.



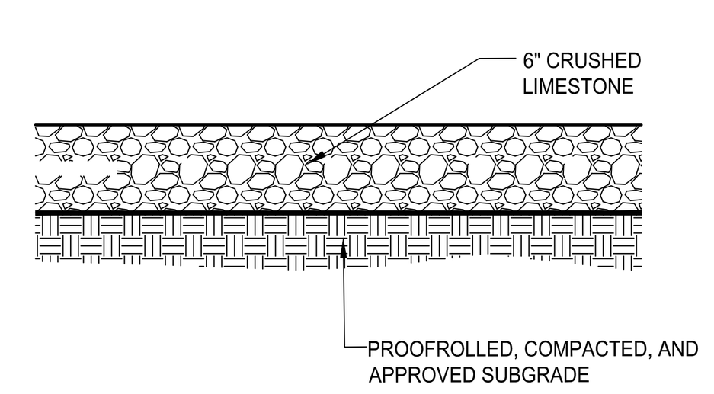
NOTE:
ALL PERFORATED UNDERDRAINS SHALL HAVE TRENCHES THAT ARE OVER-EXCAVATED AND BACKFILLED WITH MDOT CLASS II SAND AND COMPACTED IN PLACE DOWN TO THE EXISTING NATIVE SAND LAYER. REFER TO THE GEOTECHNICAL REPORT AND COORDINATE WITH THE GEOTECHNICAL FIELD ENGINEER.

STORM SYSTEM PERFORATED UNDERDRAIN SECTION
N.T.S.

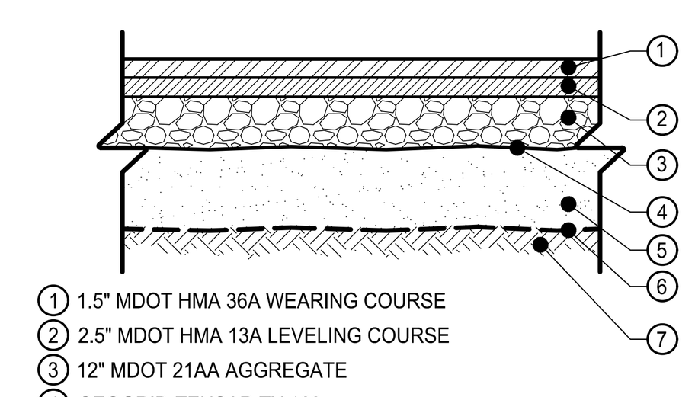
1



C-4 ROLLED CURB & GUTTER
N.T.S.



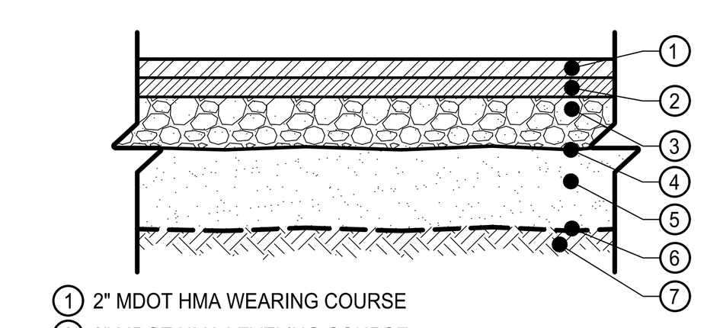
GRAVEL SURFACE
N.T.S.



1. 1.5" MDOT HMA 36A WEARING COURSE
2. 2.5" MDOT HMA 13A LEVELING COURSE
3. 12" MDOT 21AA AGGREGATE
4. GEOGRID-TENSAR TX 160
5. 12" MDOT CLASS II SAND
6. NON-WOVEN GEOTEXTILE, STABILIZATION
7. COMPACTED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.

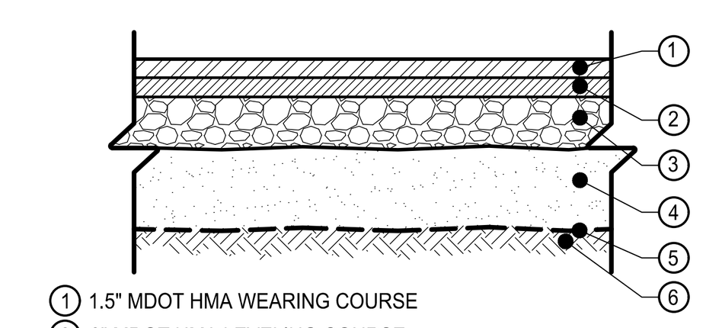
MEDIUM DUTY ASPHALT PAVEMENT (RECORD DRAWING)
N.T.S.



1. 2" MDOT HMA WEARING COURSE
2. 3" MDOT HMA LEVELING COURSE
3. 8" MDOT 21AA AGGREGATE
4. GEOGRID TENSAR BX 1200, AS REQUIRED BY GEOTECHNICAL
5. 12" MDOT CLASS II SAND
6. NON-WOVEN GEOTEXTILE, STABILIZATION, AS REQUIRED BY GEOTECHNICAL
7. COMPACTED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.

HEAVY DUTY ASPHALT PAVEMENT SECTION
N.T.S.

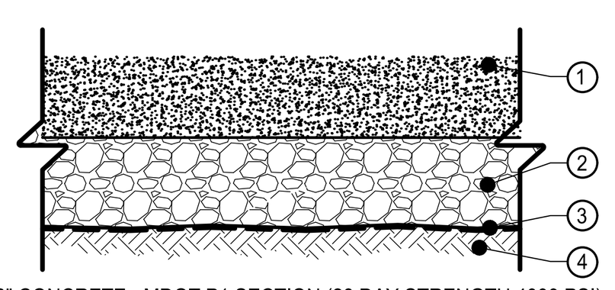


1. 1.5" MDOT HMA WEARING COURSE
2. 2" MDOT HMA LEVELING COURSE
3. 8" MDOT 21AA AGGREGATE
4. 12" MDOT CLASS II SAND
5. NON-WOVEN GEOTEXTILE, STABILIZATION, AS REQUIRED BY GEOTECHNICAL
6. COMPACTED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.

STANDARD DUTY ASPHALT PAVEMENT SECTION
N.T.S.

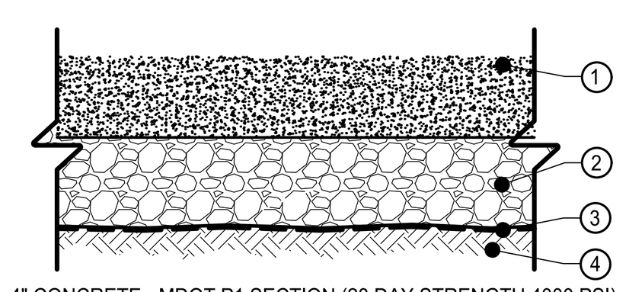
1



1. 8" CONCRETE - MDOT P1 SECTION (28 DAY STRENGTH 4000 PSI)
2. 8" MDOT 21AA - AGGREGATE BASE COURSE HEAVY DUTY INCLUDING 1' BEYOND CURB
3. NON-WOVEN GEOTEXTILE, STABILIZATION, AS REQUIRED BY GEOTECHNICAL
4. COMPACTED SUBGRADE, PROOFROLLED AND APPROVED SUBGRADE

NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.

HEAVY DUTY CONCRETE PAVEMENT SECTION
N.T.S.

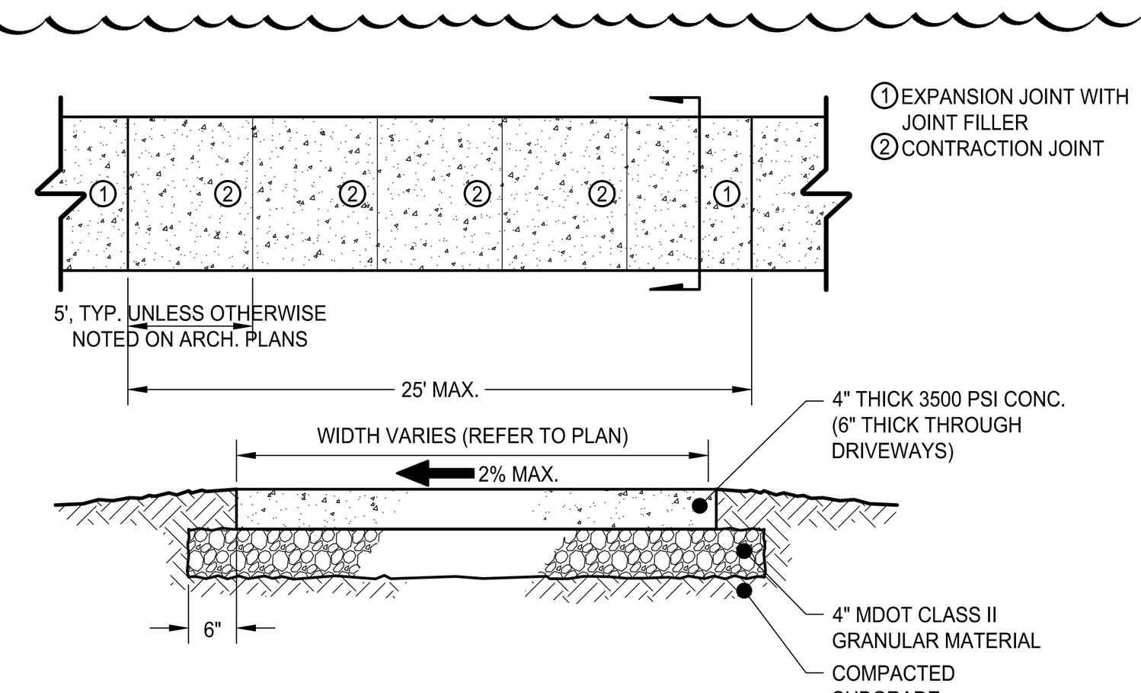


1. 4" CONCRETE - MDOT P1 SECTION (28 DAY STRENGTH 4000 PSI)
2. 5" MDOT 21AA - AGGREGATE BASE COURSE HEAVY DUTY INCLUDING 1' BEYOND CURB
3. NON-WOVEN GEOTEXTILE, STABILIZATION, AS REQUIRED BY GEOTECHNICAL
4. COMPACTED SUBGRADE, PROOFROLLED AND APPROVED SUBGRADE

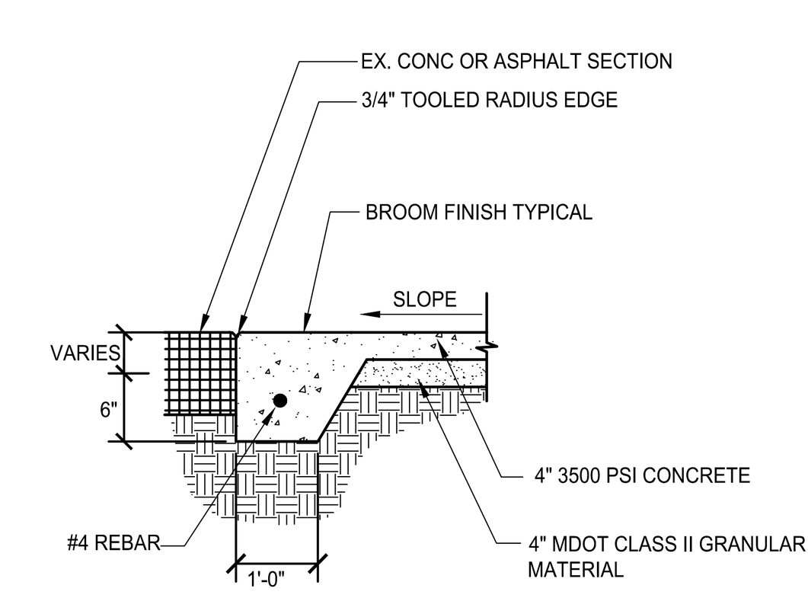
NOTES:
1. COMPACT SUBGRADE TO A MODIFIED PROCTOR DENSITY OF 95%
2. SUBBASE COURSE SHALL HAVE NO MORE THAN (7%) SEVEN PERCENT BY WEIGHT FINER THAN NO. 200 SIEVE.
3. SECTION APPLIES TO PEDESTRIAN ONLY AREAS.

STANDARD DUTY CONCRETE PAVEMENT SECTION
N.T.S.

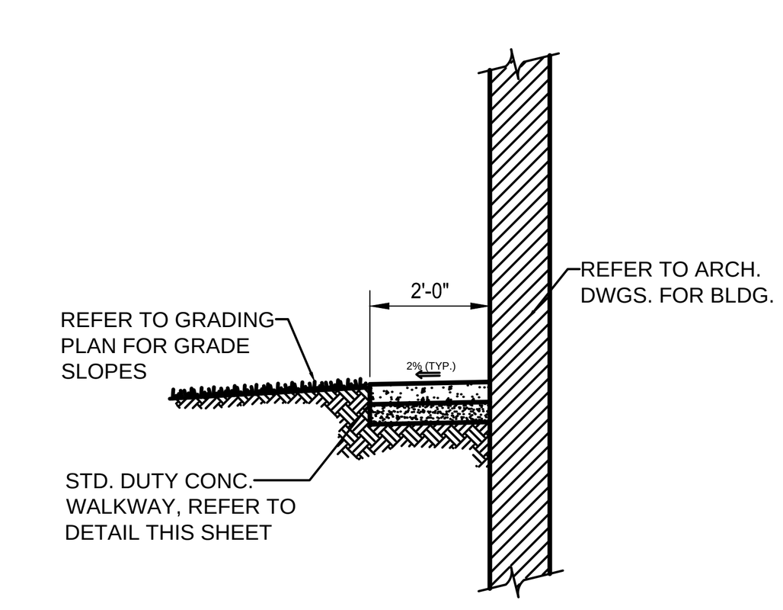
CONCRETE NOTE:
ALL CONCRETE IS TO BE REINFORCED USING FORTA-FERRO MACRO-SYNTHETIC FIBERS, 2-1/4 INCHES LONG AT 6 POUNDS PER CUBIC YARD (OR EQUAL).



CONCRETE SIDEWALK DETAIL
N.T.S.



THICKENED EDGE WALK DETAIL
N.T.S.



CONCRETE MAINTENANCE STRIP
N.T.S.

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LANSING MI 48911

NOT FOR CONSTRUCTION

Colliers Engineering & Design
LANSING (BA)
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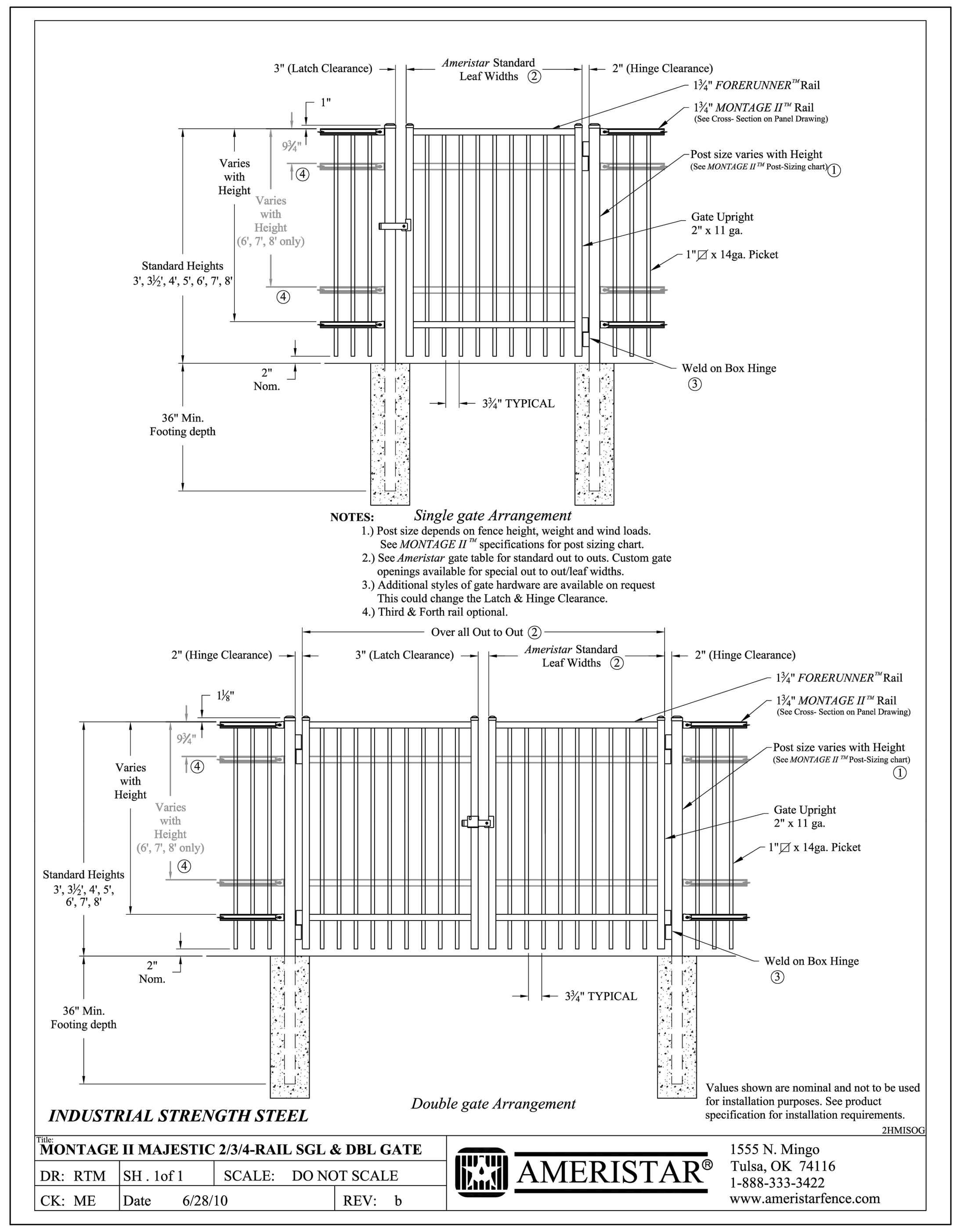
Lansing, MI 48917
Phone: 517.272.9835
COLLIERS ENGINEERING & DESIGN, ARCHITECTURE, LANDSCAPE ARCHITECTURE, SURVEYING CT, P.C.

SCALE: AS SHOWN	DRAWN BY: A. BOCKTING
DESIGNED BY: J. ROZEMA	REVIEWED BY: J. ROZEMA
DATE ISSUED: 12/03/2025	PROJECT NUMBER: 25009299A

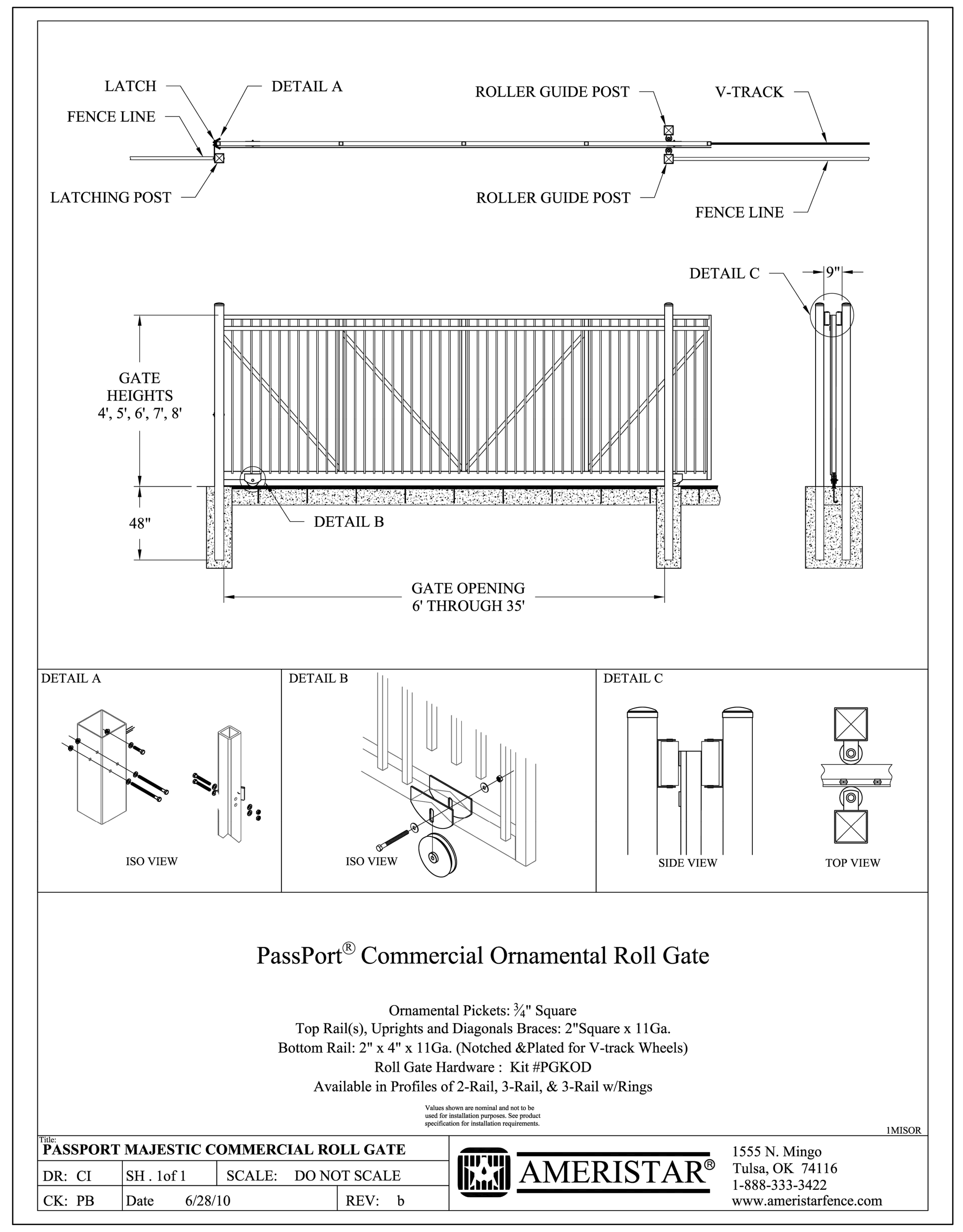
SHEET NAME:
SITE DETAILS

DRAWING NUMBER:
C700

NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.



3" (Latch Clearance)
Ameristar Standard Leaf Widths ②
2" (Hinge Clearance)
1¾" FORERUNNER™ Rail
1¾" MONTAGE II™ Rail
Post size varies with Height
Gate Upright 2" x 11 ga.
Weld on Box Hinge ⑤
Standard Heights 3', 3½', 4', 5', 6', 7', 8'
36" Min. Footing depth
3¾" TYPICAL
Single gate Arrangement
NOTES:
1.) Post size depends on fence height, weight and wind loads. See MONTAGE II™ specifications for post sizing chart.
2.) See Ameristar gate table for standard out to outs. Custom gate openings available for special out to out/leaf widths.
3.) Additional styles of gate hardware are available on request This could change the Latch & Hinge Clearance.
4.) Third & Forth rail optional.
Over all Out to Out ②
Double gate Arrangement
INDUSTRIAL STRENGTH STEEL
Values shown are nominal and not to be used for installation purposes. See product specification for installation requirements.
MONTAGE II MAJESTIC 2/3/4-RAIL SGL & DBL GATE
DR: RTM SH. 1of 1 SCALE: DO NOT SCALE
CK: ME Date 6/28/10 REV: b
AMERISTAR®
1555 N. Mingo
Tulsa, OK 74116
1-888-333-3422
www.ameristarfence.com



LATCH
FENCE LINE
LATCHING POST
DETAIL A
ROLLER GUIDE POST
V-TRACK
FENCE LINE
DETAIL C
GATE HEIGHTS 4', 5', 6', 7', 8'
48"
DETAIL B
GATE OPENING 6' THROUGH 35'
DETAIL A
ISO VIEW
DETAIL B
ISO VIEW
DETAIL C
SIDE VIEW
TOP VIEW
PassPort® Commercial Ornamental Roll Gate
Ornamental Pickets: ¾" Square
Top Rail(s), Uprights and Diagonals Braces: 2"Square x 11Ga.
Bottom Rail: 2" x 4" x 11Ga. (Notched &Plated for V-track Wheels)
Roll Gate Hardware : Kit #PGKOD
Available in Profiles of 2-Rail, 3-Rail, & 3-Rail w/Rings
PASSPORT MAJESTIC COMMERCIAL ROLL GATE
DR: CI SH. 1of 1 SCALE: DO NOT SCALE
CK: PB Date 6/28/10 REV: b
AMERISTAR®
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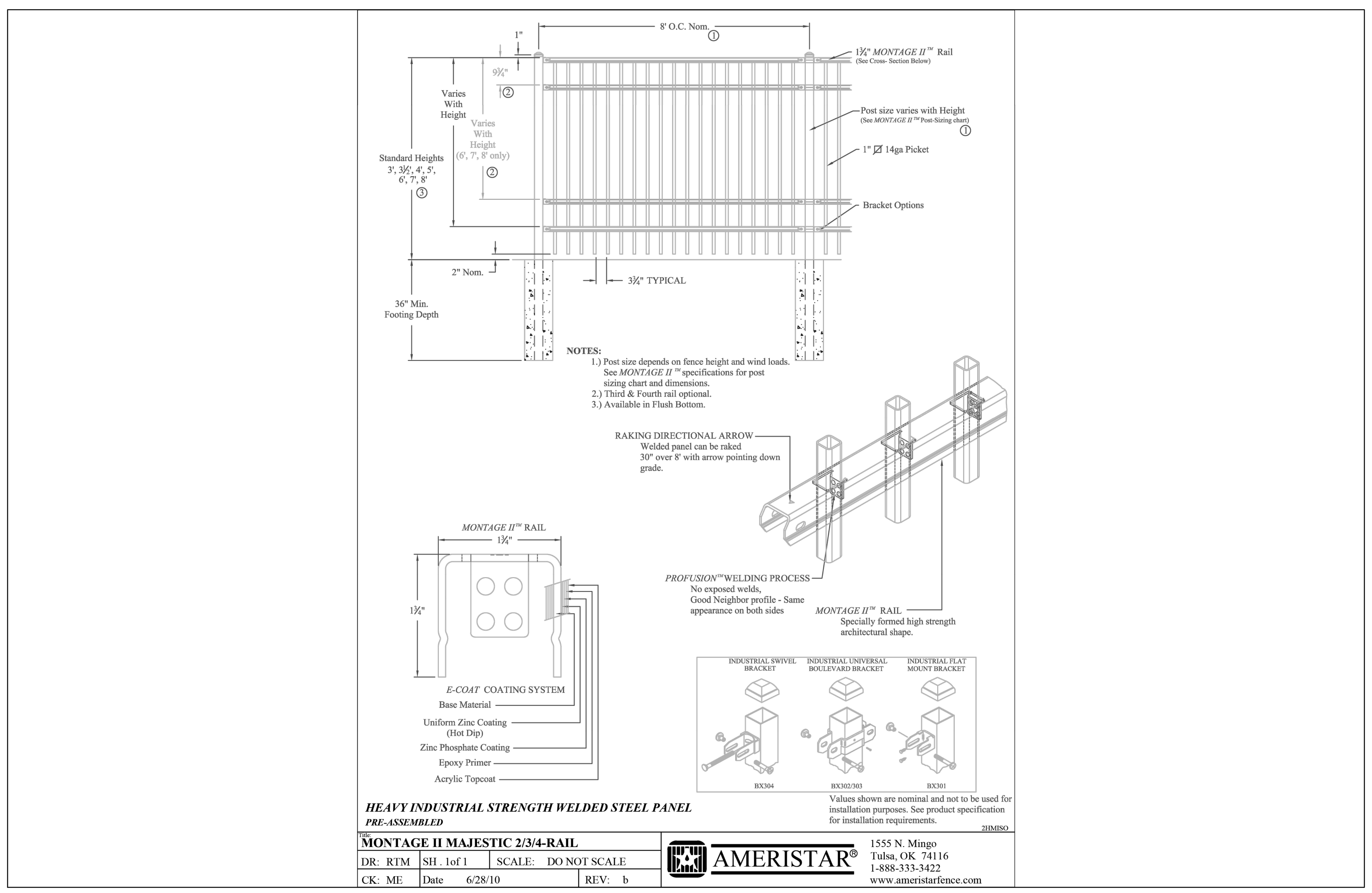

8' O.C. Nom. ①
1¾" MONTAGE II™ Rail
Post size varies with Height
1" 14ga Picket
Bracket Options
Standard Heights 3', 3½', 4', 5', 6', 7', 8'
2" Nom.
3¾" TYPICAL
36" Min. Footing Depth
NOTES:
1.) Post size depends on fence height and wind loads. See MONTAGE II™ specifications for post sizing chart and dimensions.
2.) Third & Fourth rail optional.
3.) Available in Flush Bottom.
RAKING DIRECTIONAL ARROW
Welded panel can be raked 30" over 8' with arrow pointing down grade.
MONTAGE II™ RAIL
E-COAT COATING SYSTEM
Base Material
Uniform Zinc Coating (Hot Dip)
Zinc Phosphate Coating
Epoxy Primer
Acrylic Topcoat
PROFUSION™ WELDING PROCESS
No exposed welds, Good Neighbor profile - Same appearance on both sides
MONTAGE II™ RAIL
Specially formed high strength architectural shape.
HEAVY INDUSTRIAL STRENGTH WELDED STEEL PANEL
PRE-ASSEMBLED
Values shown are nominal and not to be used for installation purposes. See product specification for installation requirements.
MONTAGE II MAJESTIC 2/3/4-RAIL
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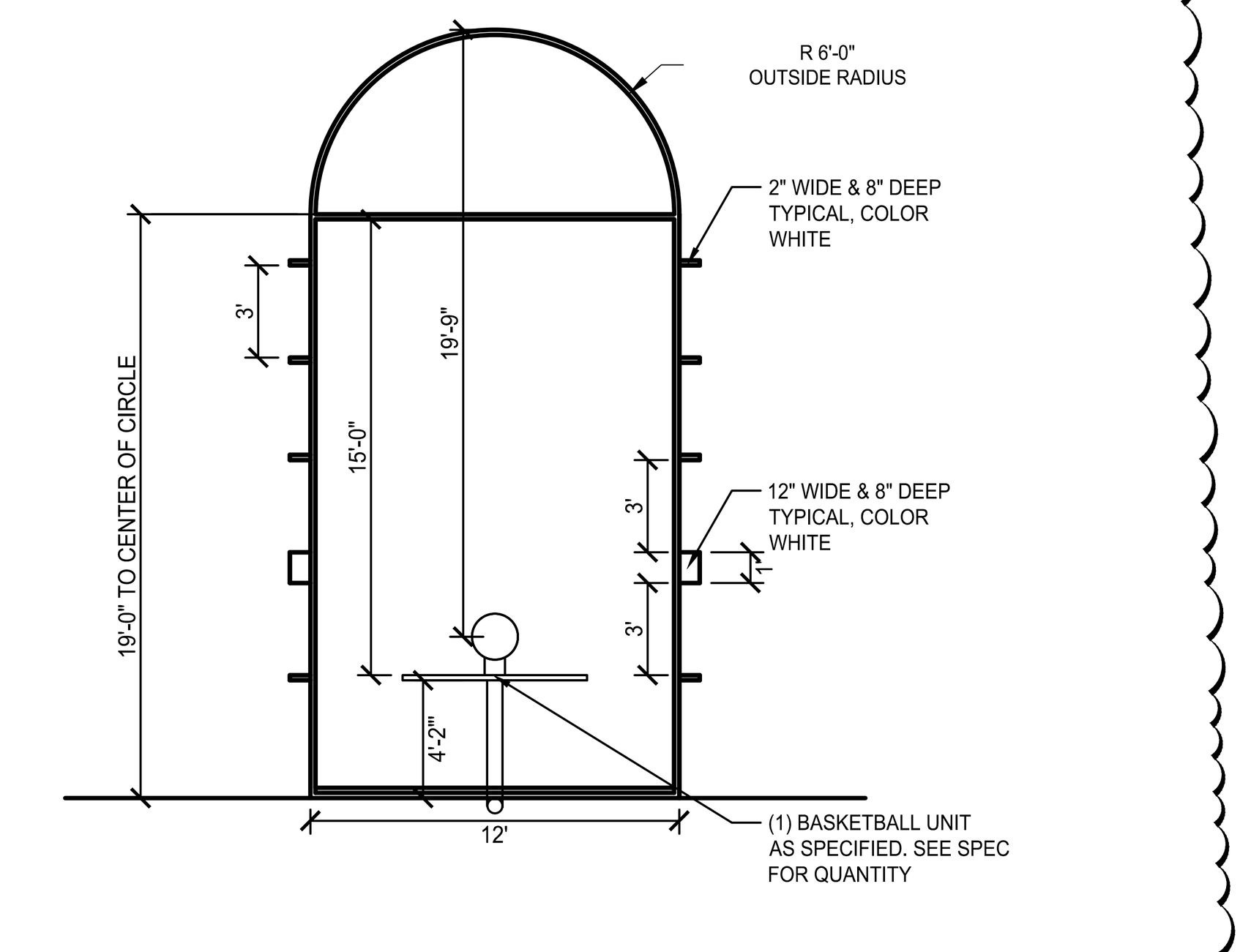
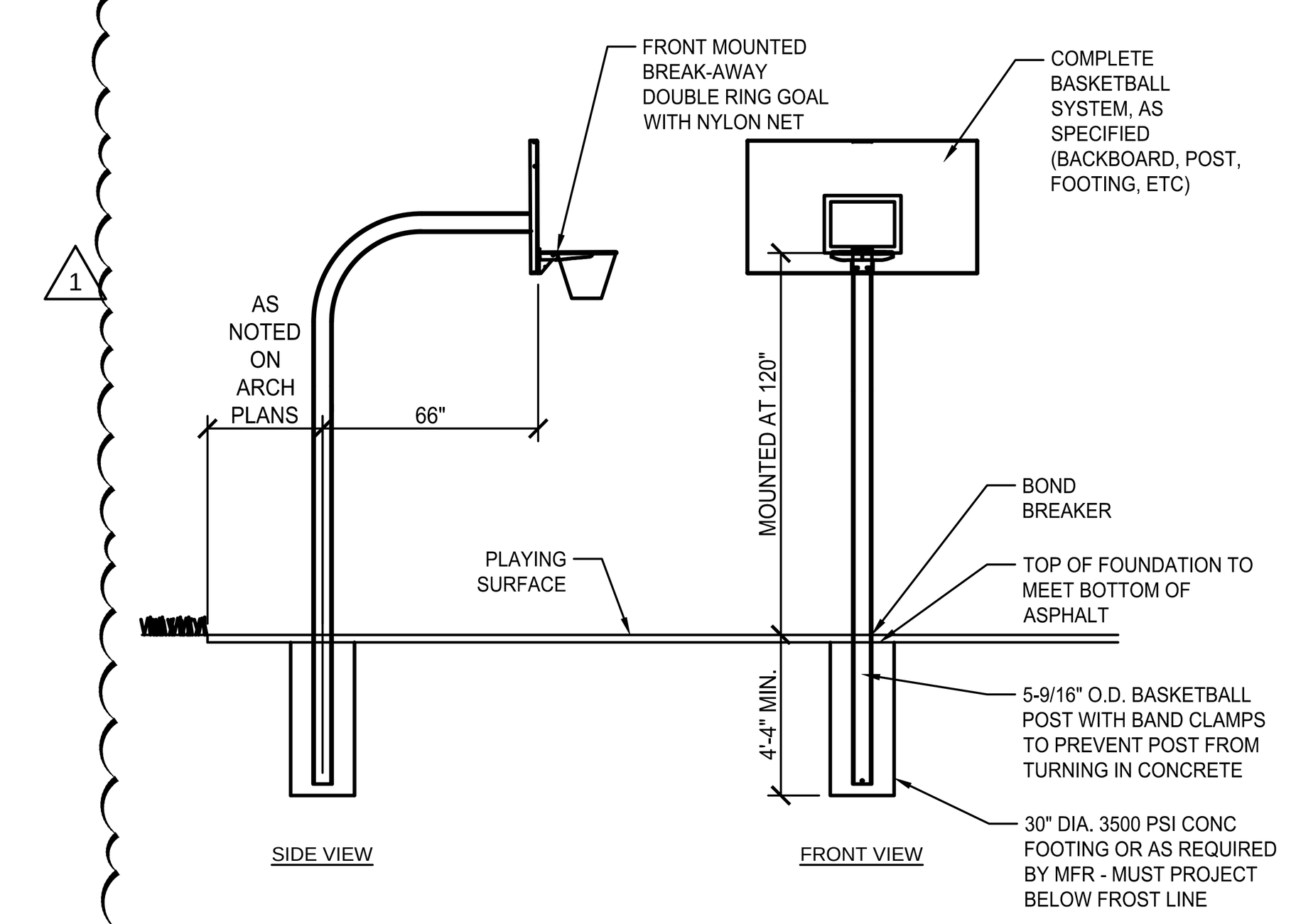


BASKETBALL - KEY LAYOUT

NOT TO SCALE



FRONT MOUNTED BREAK-AWAY DOUBLE RING GOAL WITH NYLON NET
COMPLETE BASKETBALL SYSTEM, AS SPECIFIED (BACKBOARD, POST, FOOTING, ETC)
AS NOTED ON ARCH PLANS
66"
PLAYING SURFACE
MOUNTED AT 120"
BOND BREAKER
TOP OF FOUNDATION TO MEET BOTTOM OF ASPHALT
5-9/16" O.D. BASKETBALL POST WITH BAND CLAMPS TO PREVENT POST FROM TURNING IN CONCRETE
30" DIA. 3500 PSI CONC FOOTING OR AS REQUIRED BY MFR - MUST PROJECT BELOW FROST LINE
4'-4" MIN.
SIDE VIEW
FRONT VIEW

BASKETBALL BACKSTOP DETAIL

NOT TO SCALE

Colliers
Engineering & Design

www.colliersengineering.com

REV	DATE	DESCRIPTION
	11/07/25	ISSUE FOR BIDS
1	12/05/25	ADDENDUM 02

Lansing School District

CLASSROOM & GYM ADDITIONS FOR

WEXFORD MONTESSORI ACADEMY

5217 WEXFORD RD
INGHAM COUNTY
LANSING MI 48911

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C701

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ARCH D 24x36

GENERAL ARCHITECTURAL SYMBOLS

VIEW TITLE
DETAIL #
1 VIEW NAME
SCALE : 1/8" = 1'-0"

DETAIL CALLOUT
DETAIL #
SIM
A101
DRAWING #

SECTION MARKER
SECTION #
1
A101
DRAWING #

ELEVATION MARKER
Ref 1
ELEVATION #
A000
DRAWING #
Ref 1
A101
1
Ref

DETAIL SECTION
DETAIL #
1
A101
DRAWING #

BREAK MARKER

NORTH ARROW (SHOWN IN KEYPLAN)

NEW COLUMN ID

EXISTING COLUMN ID

ACCESSORY MARKER

DOOR MARKER

WINDOW TYPE MARKER

ROOM TAG
Room name
101

SCHEDULED DOOR

EXISTING DOOR

KEYNOTE

KEYNOTE (REMOVALS)

EQUIPMENT TAG

ELEVATION NOTATION

CEILING HEIGHT
8' - 0"

MATERIAL INDICATORS

- UNDISTURBED EARTH
- GRAVEL OR CRUSHED STONE
- CAST STONE
- CONCRETE
- CONCRETE MASONRY UNIT
- EXISTING
- WOOD FRAMING (CONTINUOUS)
- WOOD BLOCKING (DISCONTIN.)
- STEEL
- RIGID INSULATION
- BRICK
- PLYWOOD
- SAND OR GYPSUM BOARD
- FINISH WOOD
- BATT INSULATION

WALL STYLES

- EXISTING BRICK WALL
- EXISTING CMU WALL
- EXISTING STUD WALL
- BRICK WALL
- CMU WALL
- STUD WALL
- EXISTING WALL REMOVAL

GENERAL NOTE WITH A PROJECT MANUAL

ALL GENERAL NOTES PERTAIN TO ALL ARCHITECTURAL (A-SERIES) DRAWINGS IN THIS SET
GENERAL

1. DEFINITIONS: "PROVIDE" MEANS FURNISH AND INSTALL, SUPPLY LABOR AND MATERIALS TO RESULT IN A FINISHED AND/OR OPERABLE SYSTEM.
2. CONTRACTOR RESPONSIBILITIES:
   A. MATERIALS, CONSTRUCTION METHODS INCLUDING BUT NOT LIMITED TO LAYOUT, COORDINATION, SCHEDULE AND CONSTRUCTION SITE ACCESS AND WORK.
   B. DAILY CLEANING: KEEP SITE FREE FROM WASTE, RUBBISH, AND DEBRIS, ALL OF WHICH SHALL BE REMOVED AND DISPOSED OF PROPERLY DAILY.
   C. FINAL CLEANING: PRIOR TO PUNCHLIST INSPECTION, BROOM CLEAN ALL HARD SURFACE FLOORS; VACUUM ALL CARPETING; AND WIPE DOWN ALL HORIZONTAL AND GLASS SURFACES, THEREBY PROVIDING DUST FREE SURFACES.
   D. TEMPORARY PROTECTION IS REQUIRED TO MAINTAIN ONGOING BUILDING OPERATIONS, EXITING PATHS, DUST CONTROL AND OCCUPANT SAFETY. IDENTIFY THE REQUIREMENTS FOR TEMPORARY PROTECTION AND PROJECT PHASING. COORDINATE WITH OWNER FOR OTHER REQUIREMENTS.
   E. COORDINATE STARTUP AND ADJUSTING OF EQUIPMENT AND OPERATING COMPONENTS. START EQUIPMENT AND OPERATING COMPONENTS AND TEST TO CONFIRM PROPER OPERATION AND CONTROL. REMOVE MALFUNCTIONING UNITS, REPLACE WITH NEW UNITS, AND RETEST.
   F. CLOSEOUT DOCUMENTS, CERTIFICATE OF RELEASE FROM THE AUTHORITY OF JURISDICTION AND INSURANCE FOR CONTINUING COVERAGE, WARRANTIES, TEST & INSPECTION RESULTS AND OPERATION, EMERGENCY & MAINTENANCE MANUALS.
3. CONTRACT DOCUMENTS:
   A. PLANS, ELEVATIONS, SECTIONS, DETAILS AND SCHEDULES ARE COMPLEMENTARY. PLAN DRAWINGS WILL TAKE PRECEDENCE OVER ELEVATION, SECTION AND DETAILS DRAWINGS IN ANY CONFLICTS OF HORIZONTAL DIMENSIONS. DETAIL PLAN DRAWINGS WILL TAKE PRECEDENCE OVER LARGER SCALE PLANS IN ANY CONFLICTS WITH HORIZONTAL DIMENSIONS. WALL AND BUILDING SECTIONS WILL TAKE PRECEDENCE OVER PLAN DRAWING AND DETAILS IN ANY CONFLICTS WITH VERTICAL DIMENSIONS. DETAILS AND WALL SECTIONS WILL TAKE PRECEDENCE OVER ELEVATION AND PLAN DRAWINGS IN ANY CONFLICTS WITH MATERIAL DESCRIPTION. SCHEDULES WILL TAKE PRECEDENCE OVER OTHER ARCHITECTURAL DRAWINGS IN AND CONFLICTS WITH WALL, FLOOR AND CEILING FINISHES AND DOOR, DOOR HARDWARE AND FENESTRATION INFORMATION.
   B. DRAWINGS AND SPECIFICATIONS PREPARED BY THE ARCHITECT ARE INSTRUMENTS OF THE ARCHITECT'S SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT AND, UNLESS OTHERWISE PROVIDED, BERGMANN SHALL BE DEEMED THE AUTHOR OF THESE DOCUMENTS AND RETAIN ALL COMMON LAW, STATUTORY AND OTHER RESERVED RIGHTS, INCLUDING THE COPYRIGHT.
   C. WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDUM.

FINISHES

1. GENERAL: FINISHED FLOORS EXTEND INTO TOE SPACES, CLOSETS, DOOR REVEALS AND SIMILAR OPENINGS.
2. PRODUCTS:
   A. PAINT DESIGNATIONS INDICATE COLOR ONLY, REFER TO SPECIFICATION FOR FINISH TYPE.
   B. PROVIDE SELF LEVELING TROWELABLE UNDERLAYMENT WHERE REQUIRED TO OBTAIN FINISH MANUFACTURER'S REQUIRED SUBFLOOR CONDITION.
   C. PROVIDE THE REQUIRED TRANSITIONS BASED ON TYPES IDENTIFIED ON DRAWINGS AT EACH FINISH TRANSITION LOCATION.

ENERGY CODE STATEMENT:
TO THE BEST OF THE REGISTERED DESIGN PROFESSIONAL'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND/OR SPECIFICATIONS ARE IN COMPLIANCE WITH THE APPLICABLE CODES.

UNIFORM CODE STATEMENT:
TO THE BEST OF THE REGISTERED DESIGN PROFESSIONAL'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND/OR SPECIFICATIONS ARE IN COMPLIANCE WITH THE APPLICABLE CODES.

ABBREVIATIONS

"	INCHES
#	NUMBER, POUNDS
&	AND
'	FEET
(E), EXST	EXISTING TO REMAIN
(ER)	EXISTING TO BE RELOCATED
(R)	REMOVE
(RE)	RELOCATED EXISTING
@	AT
Ø, DIA	DIAMETER
A	
A/C	AIR CONDITIONING
ACP	ACOUSTICAL CEILING PANELS
AESS	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
ALUM	ALUMINUM
AOR	ARCHITECT OF RECORD
APPROX	APPROXIMATE, APPROXIMATELY
ARCH	ARCHITECT, ARCHITECTURAL
ATTN	ATTENTION
B	
B/, BO	BOTTOM OF
BD	BOARD
BLDG	BUILDING
BLKG	BLOCKING
BTWN	BETWEEN
C	
CANT	CANTILEVER
CG	CORNER GUARD
CJ	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CM	CONSTRUCTION MANAGER
CMT	CERAMIC MOSAIC TILE
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUOUS
COR	CORRIDOR
CT	CERAMIC TILE
CTB	CERAMIC TILE BASE
D	
D	DEEP, DEPTH
DF	DRINKING FOUNTAIN
DIA, Ø	DIAMETER
DIM	DIMENSION
DWG, DWGS	DRAWING, DRAWINGS
E	
EA	EACH
EIFS	EXTERIOR INSULATION FINISH SYSTEM
EL	ELEVATION
ELEC	ELECTRIC, ELECTRICAL
ELEV	ELEVATOR
EXF	EPOXY FLOORING
EXP	EXPANSION
EXP BT	EXPANSION BOLT
EXT	EXTERIOR
F	
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FFE	FINISH FLOOR ELEVATION
FLG	FLOORING
FLR	FLOOR
FPR	FIBER REINFORCED PLASTIC
FR	FIRE RATED
FRT	FIRE RETARDANT TREATED
FT	FLOOR TILE
FT	FIRE TREATED
FTG	FOOTING
G	
GA	GAUGE
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GRC	GLASS-REINFORCED CONCRETE
GRG	GLASS-REINFORCED GYPSUM
GWB	GYPSUM BOARD
H	
HB	HOSE BIBB
HC	HOLLOW CORE
HDR	HEADER
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HPC	HIGH PERFORMANCE COATING
HW	HOT WATER
HWD	HARDWARE
HWT	HOT WATER TANK
I	
ID	INSIDE DIAMETER
IN WG	INCH OF WATER GAUGE
INSUL	INSULATION
INT	INTERIOR
INV	INVERT
J	
JC	JANITORS CLOSET
JT	JOINT
L	
LAM	LAMINATE
LAV	LAVATORY
LBS	POUNDS
LF	LINEAR FEET
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LMC	LINEAR METAL CEILING
LT	LIGHT
LTL	LINTEL
LVR	LOUVER
LVT	LUXURY VINYL TILE
M	
MAX	MAXIMUM
MCM	METAL COMPOSITE MATERIAL
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MIN	MINIMUM
MO	MASONRY OPENING
MTD	MOUNTED
MTL	METAL
N	
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
O	
OC	ON CENTER
OPP	OPPOSITE
OSB	ORIENTED STRAND BOARD
P	
PCC	PRECAST CONCRETE
PCF	POUNDS PER CUBIC FOOT
PL	PLATE
PLF	POUNDS PER LINEAR FOOT
PLM	PLASTIC LAMINATE
PLYWD	PLYWOOD
PMEJ	PRE MOLDED EXPANSION JOINT
PMF	PRE MOLDED FILLER
PP	PLASTIC PANELING
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PORCELAIN TILE
PTD	PAINTED
PTWD	(PRESSURE) PRESERVATIVE-TREATED WOOD
Q	
QT	QUARRY TILE
QTY	QUANTITY
R	
R	RISER
RB	RUBBER BASE
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REBAR	REINFORCING BAR
REINF	REINFORCED, REINFORCING, REINFORCEMENT
REQD	REQUIRED
REQMTS	REQUIREMENTS
RESIL	RESILIENT
RF	RESILIENT FLOORING
RM	ROOM
RO	ROUGH OPENING
RTU	ROOF TOP UNIT
S	
SC	SEALED CONCRETE
SCHED	SCHEDULE
SCL	STRUCTURAL COMPOSITE LUMBER
SF, SQFT	SQUARE FEET
SIM	SIMILAR
SMS	SHEET METAL SCREW
SOG	SLAB ON GRADE / GROUND
SPCS	SPACES
SPEC	SPECIFICATION
SS	SOLID SURFACE
SSL	SHORT SLOTTED
SST	STAINLESS STEEL
STC	SOUND TRANSMISSION CLASS
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL, STRUCTURE
SYS	SYSTEM
T	
T	TREAD
T&G	TONGUE AND GROOVE
TEMP	TEMPORARY
TH	THRESHOLD
TL	TWIST LOCK
TR	TRANSITION
TYP	TYPICAL
U	
UON	UNLESS OTHERWISE NOTED
UPH	UPHOLSTERY
UR	URINAL
V	
VAR	VARIES
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VEST	VESTIBULE
VIF	VERIFY IN FIELD
VWC	VINYL WALL COVERING
W	
W	WIDE, WIDTH
W/	WITH
W/O	WITHOUT
WB	WOOD BASE
WC	WATER CLOSET
WCV	WALL COVERING
WD	WOOD
WDT	WINDOW TREATMENT
WOM	WALKOFF MAT
WP	WORK POINT
WRB	WEATHER RESISTANT BARRIER
WT	WALL TILE

PARTITION NOTES

WALLS

A. DIMENSIONS:
   a. STUD WALLS ARE TO FACE OF STUD, UNLESS OTHERWISE INDICATED IN A.c. OR A.d. BELOW.
   b. MASONRY WALLS ARE TO FACE OF MASONRY.
   c. EXISTING CONSTRUCTION ARE TO FINISHED FACE OF CONSTRUCTION.
   d. WHERE NOTED AS "CLR" DIMENSIONS ARE TO FINISHED SURFACE AND ARE CRITICAL FOR ACCESSIBILITY REQUIREMENTS OR BUILT-IN FURNISHINGS.

B. TYPES:
   a. WALLS NOT INDICATED WITH A WALL TYPE SHALL BE TYPE C80.
   b. COLUMN ENCLOSURES, CHASES AND ENCLOSED UNINHABITABLE SPACES SHALL BE WALL TYPE M31, UNLESS NOTED OTHERWISE.
   c. BRACING: PROVIDE CHANNEL COLD ROLLED STEEL (CRSS) BRACING AT ALL METAL STUD WALLS. INSTALL TWO ROWS OF BRACING 4'-0" O.C. FOR WALLS UP TO 13'-0" HIGH.
   d. PROVIDE (2) #10-7/16" HEX HEAD SHEET METAL SCREWS AT EACH STUD/TRACK CONNECTION AT ALL WALLS, BULK HEADS & SOFFITS NOT EXTENDING FLOOR TO DECK.
   e. PROVIDE DEFLECTION TRACK OR CLIP AT TOP OF METAL STUD WALLS THAT EXTEND TO THE UNDERSIDE OF STRUCTURAL MEMBERS OR FLOOR/ ROOF DECK.
   f. METAL STUD WALLS IN WHICH STUDS DO NOT EXTEND TO DECK ABOVE SHALL BE LATERALLY BRACED AT 45 DEGREES TO THE STRUCTURE ABOVE WITH 3 5/8" x 20 GA. STUDS @ 48" O.C. MAX., AND AT ENDS OF SUCH WALLS WHICH DO NOT INTERSECT OTHER WALLS.
   g. PROVIDE FULL HEIGHT DOUBLE STUDS AT DOOR AND WINDOW JAMBS.
   h. FIRE-RESISTANT JOINT SYSTEMS: AT FIRE-RESISTANT RATED WALLS, FLOORS OR FLOOR/CEILING ASSEMBLIES, AND ROOFS OR ROOF/CEILING ASSEMBLIES, PROVIDE AN APPROVED TESTED JOINT ASSEMBLY PROVIDING THE MINIMUM TIME AND TEMPERATURE RISE AT THE WALL, FLOOR, OR ROOF SUITABLE FOR THE CONSTRUCTION WHERE THE SYSTEM IS TO BE INSTALLED.
   i. THE BOTTOM EDGE OF GYPSUM WALL BOARD SHALL BE INSTALLED 3/8" ABOVE THE FLOOR AND SEALED AS NOTED IN WALL TYPES.

C. RATINGS:
   a. SMOKE WALLS AND SMOKE BARRIERS: SMOKE WALLS AND SMOKE BARRIERS MUST FORM A COMPLETE BARRIER TO LIMIT THE TRANSFER OF SMOKE, INCLUDING PERIMETER DETAILS, PENETRATIONS, AND AS REQUIRED BETWEEN WALLS AND DOOR JAMBS, OR SIDELIGHT FRAMES. THE MEMBRANE IS TO BE CONTINUOUS THROUGH ALL CONCEALED SPACES.
      1. RECESSED CABINETS, OUTLET BOXES, AND OTHER PENETRATIONS MUST BE SEALED
      2. OPENINGS AROUND PENETRATIONS ARE TO BE SEALED.
      3. ALL EXPOSED JOINTS, ANGLES, AND ABUTMENTS IN THE SYSTEM, INCLUDING FLOOR AND ABOVE CEILING MUST BE TAPED AND FINISHED.
      4. SEAL THE INTERFACE BETWEEN WALLS AND DOOR JAMBS, OR SIDELIGHT FRAMES.
   b. FIRE WALLS AND FIRE BARRIERS: FIRE WALLS AND FIRE BARRIERS MUST BE SIMILARLY CONSTRUCTED AS A COMPLETE BARRIER TO RESIST THE SPREAD OF SMOKE AND FIRE. PENETRATIONS MUST BE SEALED AND LABELED WITH AN APPROVED FIRE RESISTANT JOINT SYSTEM. INSTALL A FIRE RESISTANT JOINT SYSTEM AT THE HEAD AND FLOOR CONDITION OF FIRE RATED WALLS AND BARRIERS.
   c. FIRE AND SMOKE WALL / BARRIER / WALLS LABELING:
      1. WHERE THERE IS AN ACCESSIBLE CONCEALED FLOOR, FLOOR-CEILING, OR ATTIC SPACE, FIRE WALLS, FIRE BARRIERS, FIRE PARTITIONS, SMOKE BARRIERS, AND SMOKE PARTITIONS OR ANY OTHER WALL REQUIRED TO HAVE PROTECTED OPENINGS OR PENETRATIONS SHALL BE EFFECTIVELY AND PERMANENTLY IDENTIFIED WITH SIGNS OR STENCILING IN THE CONCEALED SPACE. SUCH IDENTIFICATION SHALL:
         A. BE LOCATED WITHIN 15 FEET (4572 MM) OF THE END OF EACH WALL AND AT INTERVALS NOT EXCEEDING 30 FEET (9144 MM) MEASURED HORIZONTALLY ALONG THE WALL OR PARTITION.
         B. INCLUDE LETTERING NOT LESS THAN 3 INCHES (76 MM) IN HEIGHT WITH A MINIMUM 3/8-INCH (9.5 MM) STROKE IN A CONTRASTING COLOR INCORPORATING THE SUGGESTED WORDING, "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENEINGS," OR OTHER WORDING.
   d. ACOUSTICAL WALLS: WALLS INDICATED WITH ACOUSTICAL BATT, AND/OR A GIVEN AN STC RATING, SHALL BE CONSTRUCTED TO MINIMIZE SOUND TRANSMISSION AS FOLLOWS:
      1. PROVIDE ACOUSTICAL SEALANT AT ALL FLOOR AND HEAD LEVELS, EACH SIDE OF THE WALLS.
      2. SET TRACK IN 3 CONTINUOUS BEADS OF ACOUSTICAL SEALANT.
      3. EXTEND SOUND BATTS THOROUGH ANY INTERSECTING WALLS.
      4. STAGGER OUTLETS A MINIMUM OF 24 INCHES HORIZONTAL. DO NOT INSTALL MORE THAN ONE OUTLET IN A COMMON STUD CAVITY. SEAL JOINTS AROUND OUTLETS WITH ACOUSTICAL SEALANT.

D. GYPSUM BOARD WALL COMPONENTS AND ACCESSORIES:
   a. WALL TYPES DO NOT INDICATE FINAL FINISHES. REFER TO FINISH PLANS AND FINISH SCHEDULE.
   b. GYPSUM BOARD SHALL BE TYPE "X" FIRE RATED WITH:
      1. LEVEL 1 FINISH AT JOINTS WHICH WILL REMAIN CONCEALED. PROVIDE GALVANIZED STEEL CORNER BEADS AT CORNERS.
      2. LEVEL 3 FINISH WHERE WALLS EXPOSED TO VIEW SCHEDULED FOR PAINT IN SERVICE SPACES (eg. TELE / DATA CLOSETS, MECHANICAL ROOMS, JANITOR CLOSETS, STORAGE ROOMS).
      3. LEVEL 4 FINISH WHERE EXPOSED TO VIEW UPON PROJECT COMPLETION U.N.O.
      4. LEVEL 5 FINISH AT GRAPHIC CORRIDOR, AS WELL AS DRY ERASE AND CHALK BOARD PAINTED AREAS. REFER TO FINISH LOCATION ON PLANS, AND COORDINATE WITH DESIGNER IN THE FIELD.
   c. PROVIDE MOISTURE/ MOLD / ABUSE RESISTANT GYPSUM BOARD AT WALLS IN TOILET ROOMS, JANITORS CLOSETS AND ANY ROOM WHERE MOISTURE CONDITIONS WILL OCCUR AND NOT RECEIVING TILE FINISH.
   d. PROVIDE GLASS MATT GYPSUM BOARD AT WALLS DIRECTLY ADJACENT TO LIVING WALL ELEMENT AND AT ALL WET AREAS (SHOWER ROOMS, COMMUNAL KITCHEN/DISHWASHER, ETC.) GLASS MAT GYPSUM BOARD SHALL RECEIVE FIBERGLASS TAPE AND FINISH AS RECOMMENDED BY MANUFACTURER.
   e. METAL TRIM:
      1. EXPOSED METAL J-TRIM TO BE COMPLETELY COVERED WITH SKIM COAT
      2. NON-METALIC J-TRIM OR OTHER SHAPES ARE NOT ACCEPTABLE, UNLESS OTHERWISE NOTED
   f. LOCATIONS WHERE GYPSUM BOARD WALLS TERMINATE AT DISSIMILAR MATERIALS, PROVIDE A FINISH-ABLE METAL END TRIM AND A 1/4" GAP BETWEEN TRIM AND ADJACENT MATERIAL. FILL GAP WITH BACKER ROD AND SEALANT.
   g. PROVIDE SOLID FIRE TREATED WOOD BLOCKING IN WALL AND CEILING CONSTRUCTION AS REQUIRED TO SUPPORT WALL MOUNTED MILLWORK AND CASEWORK, FURNISHINGS, RAILINGS, GRAB BARS, TOILET & BATH ACCESSORIES OR ANY OTHER WALL MOUNTED ITEMS INDICATED ON THESE DRAWINGS REQUIRING BLOCKING. REFER TO DIAGRAMS ON DRAWING A421 FOR MOUNTING LOCATIONS OF GRAB BARS.
   h. PROVIDE PAPER FACED "L" SHAPED TAPE ON TRIM AT THE TOP OF ALL GWB THAT ABUTS SUSPENDED CEILINGS AND EXPOSED STRUCTURE.

E. CONTROL JOINTS:
   a. PROVIDE IN GYPSUM WALL BOARD CONSTRUCTION AS FOLLOWS:
      1. PROVIDE CONTROL JOINTS IN EXPANSES OF WALLS AT MAXIMUM 25-FOOT INTERVALS, AND FULL HEIGHT. CONTROL JOINTS ARE RECOMMENDED AT DOOR JAMBS, EXTENDING FROM DOOR HEAD TO TOP OF WALL.
      2. CONTROL JOINTS ARE REQUIRED IN CEILINGS TO LIMIT AREAS TO 2,500 SQUARE FEET. INSTALL CONTROL JOINTS IN CEILINGS TO LIMIT DIMENSIONS IN EITHER DIRECTION TO 50 FEET MAXIMUM WITH PERIMETER RELIEF. 30 FEET MAXIMUM OTHERWISE. INSTALL CONTROL JOINTS WHERE CEILING FRAMING OR FURRING CHANGES DIRECTION.
      3. PROVIDE CONTROL JOINTS IN GYPSUM WALL BOARD WHERE THE UNDERLYING STRUCTURE CONTAINS A CONTROL OR MOVEMENT JOINT.
      4. IN AN ACOUSTICALLY RATED ASSEMBLY, PROVIDE ACOUSTICALLY TESTED CONTROL JOINT ASSEMBLY WITH A STC RATING MINIMALLY EQUAL TO THE WALLS STC RATING. COORDINATE REQUIRED LOCATIONS ON FEATURE WALLS WITH DESIGNER IN THE FIELD. METAL TRIM: EXPOSED METAL OR NON-METALLIC J-MOLD IS NOT ACCEPTABLE.
      5. PROVIDE CONTROL JOINTS AT ALL BUILDING CONTROL OR EXPANSION JOINTS.
   b. IN CONCRETE MASONRY UNIT WALLS REFER TO STRUCTURAL FOR CONTROL JOINT SPACING
   c. IN CLAY MASONRY VENEERS REFER TO ARCHITECTURAL EXTERIOR ELEVATIONS FOR EXPANSION JOINT LOCATIONS

WALL LEGEND

M60
1
- WALL MATERIAL - SEE BELOW
- WALL SIZE - SEE BELOW
- WALL TYPE - 0, 1, 2, 3 ETC.
- WALL INFORMATION

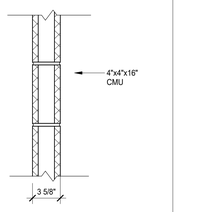
REF WALL TYPES AND DETAILS; SEE THIS SHEET

WALL MATERIAL	WALL SIZES
C = CONCRETE MASONRY UNITS	4 = 4" NOMINAL, 3 5/8" ACTUAL 8 = 8" NOMINAL, 7 5/8" ACTUAL 12 = 12" NOMINAL, 11 5/8" ACTUAL
M = METAL STUD	3 = 3-5/8" METAL STUDS @ 16" OC (UON)
WALL INFORMATION	
1 = MAINTAIN 1 HR FIRE RATING 2 = MAINTAIN 2 HR FIRE RATING 3 = WALL HEIGHT STUD FRAMING AND GWB FINISH TO DECK ABOVE 4 = SOUND ATTENUATION CAVITY BATT INSULATION FULL HEIGHT OF WALL	

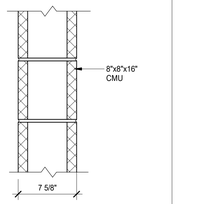
WALL TYPES

NOTE: SEE TYPICAL WALL SECTIONS FOR ADDITIONAL INFORMATION AT FLOOR AND DECK ABOVE CONDITIONS.

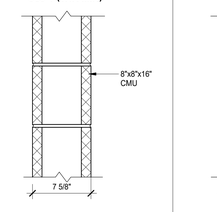
C40



C80

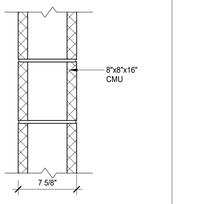


C80-1 (1HR MIN)



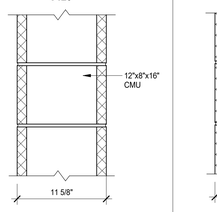
NOTE: 1-HR RATING FOR C80 TYPE IS DECLARED MINIMUM; INSTALL SHALL MEET U.L. DESIGN NO. **U905**

C80-2 (2HR)

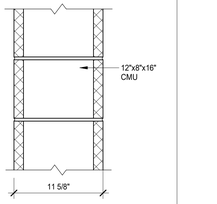


NOTE: 2-HR RATED WALLS; INSTALL SHALL MEET U.L. DESIGN NO. **U905**

C120

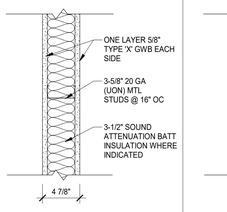


C120-2 (2HR)

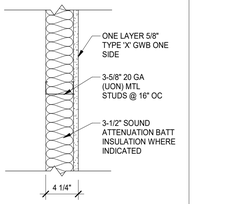


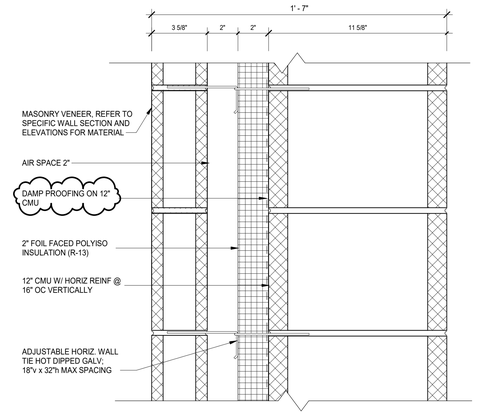
NOTE: 2-HR RATED WALLS; INSTALL SHALL MEET U.L. DESIGN NO. **U905**

M30



M31



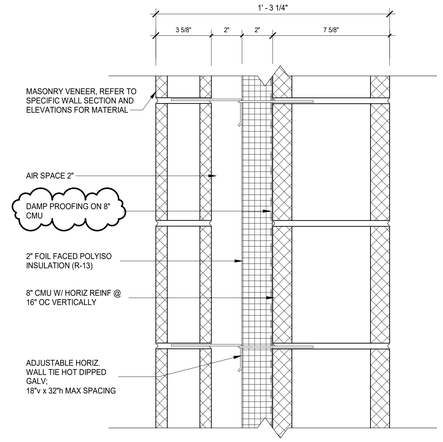


SECTION DETAIL

1 EW-1 - SECTION - VENEER/ 12" CMU
SCALE : 3" = 1'-0"

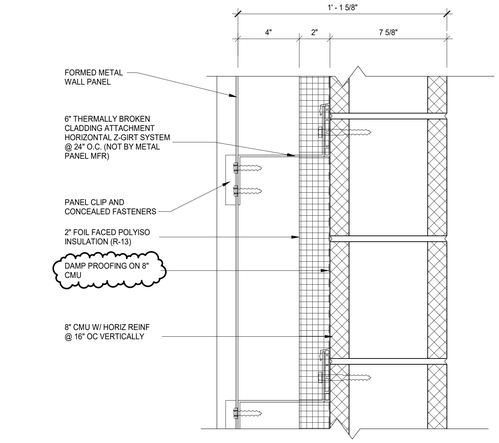
SECTION DETAIL

2 EW-2 - SECTION - MCM PANEL/ CMU
SCALE : 3" = 1'-0"



SECTION DETAIL

4 EW-4 - SECTION - VENEER/ 8" CMU
SCALE : 3" = 1'-0"



SECTION DETAIL

3 EW-3 - SECTION - FORMED MTL PANEL/ CMU
SCALE : 3" = 1'-0"

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3	10/21/25	95% OWNER REVIEW
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5	12/05/25	ADDENDUM #2

KEY PLAN

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

Colliers Engineering & Design
GRAND RAPIDS
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Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER	DISCIPLINE LEAD:
DESIGNER: E POST	REVIEWER:
DATE ISSUED: 12/05/25	PROJECT NUMBER: 25009229A

SHEET NAME:
GENERAL NOTES AND LEGENDS

DRAWING NUMBER:
A001

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ARCH D 24x36

GENERAL NOTES

A. REFER TO A002 FOR WALL TYPES, DETAILS, AND ADDITIONAL INFORMATION.

B. REFER TO A120 SERIES DRAWINGS FOR REFLECTED CEILING PLANS AND DETAILS.

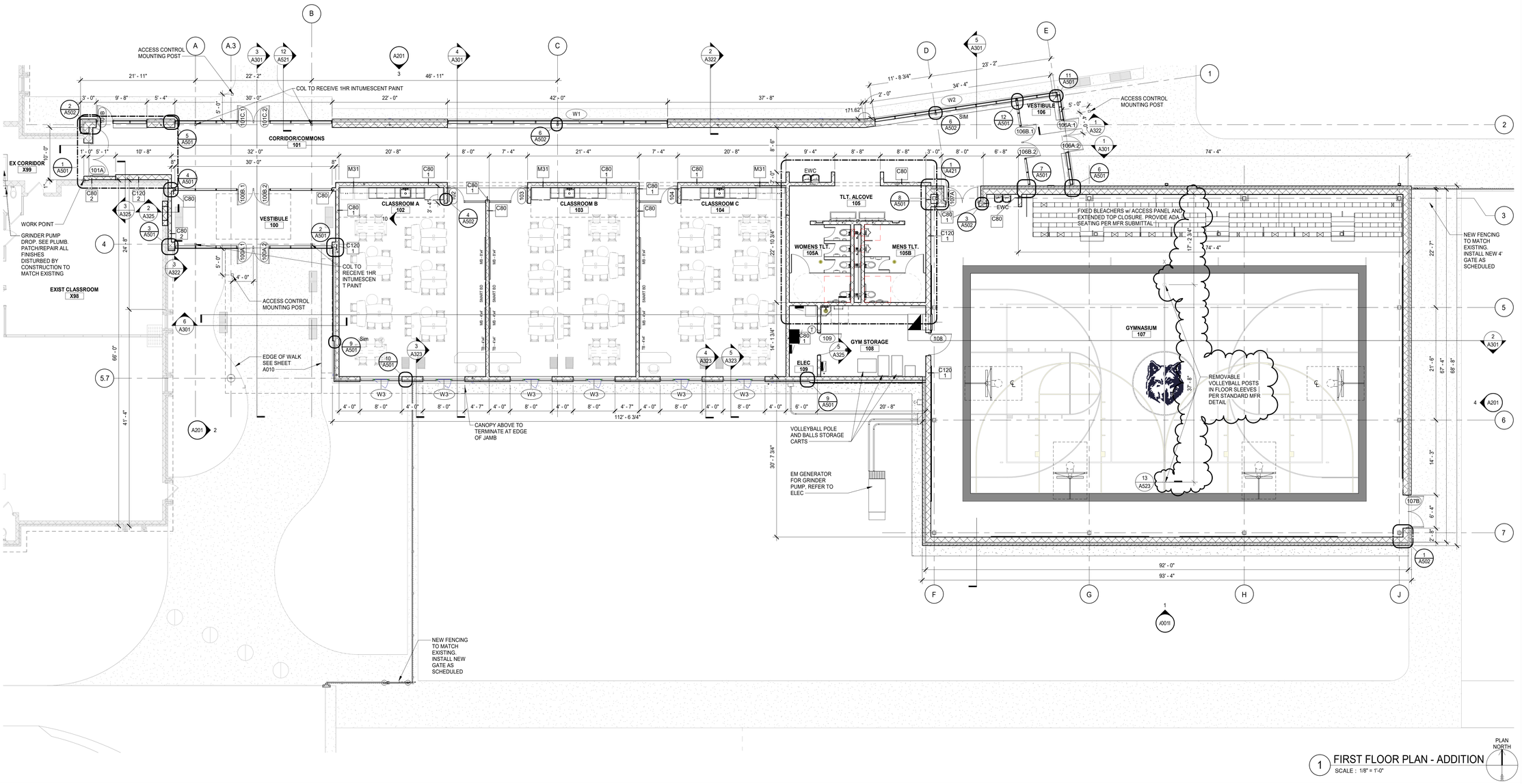
C. REFER TO A140 SERIES DRAWINGS FOR FINISH PLANS, SCHEDULES, AND DETAILS.

D. REFER TO A160 SERIES DRAWINGS FOR FURNITURE AND EQUIPMENT PLANS AND SCHEDULES.

E. REFER TO A600 SERIES DRAWINGS FOR DOOR SCHEDULE, WINDOW SCHEDULE, DETAILS, AND BASIS OF DESIGN.

F. ALL DOORS TO BE LOCATED 4" FROM DRYWALL ADJACENT WALL UNLESS OTHERWISE NOTED.

G. ALIGN FACES OF MASONRY AND STUD WALLS INDICATED IN THE SAME PLANE ON PLANS, U.O.N.



1 FIRST FLOOR PLAN - ADDITION
SCALE : 1/8" = 1'-0"

PLAN NORTH

12/5/2025 12:47:56 PM

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B HUYLER	
DESIGNER:	REVIEWER:
E POST	
DATE ISSUED:	PROJECT NUMBER:
12/05/25	25009229A

SHEET NAME:

FIRST FLOOR PLAN

DRAWING NUMBER:

A101

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FINISH HATCH LEGEND

- RAF-1
- RAF-2
- RAF-3
- RAF-4

FINISH SYMBOL LEGEND

- XX# / XX# — FLOOR FINISH / WALL BASE FINISH
- XX# — FLOOR FINISH ONLY
- X# — GENERAL WALL FINISH
- X# — ACCENT WALL FINISH - TO EXTENTS
- X# / X# — WALL FINISH ABOVE WAINSCOT / WAINSCOT FINISH
- X# — WINDOW TREATMENT
- X# — SIGNAGE TAG

KEYNOTES (#)

1 WELD SEAM BETWEEN RAF-1 AND RAF-4 WITH COORDINATING WELD ROD

GENERAL NOTES

A. COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARING AND INSTALLING FINISHES.

B. PROTECT ADJACENT WORK BY SUITABLY COVERING DURING WORK.

C. REMOVE ADHESIVE OR PAINT SPOTS FROM FINISHED FLOORS, WALLS, GLASS OR OTHER SURFACES. FINISHES TO MEET OR EXCEED CODE REQUIREMENTS.

D. INSTALL MATERIALS USING MANUFACTURER'S APPROVED ADHESIVES AND METHODS, U.O.N.

E. FILL MINOR DRYWALL IRREGULARITIES WITH SPACKLING COMPOUND AND SAND TO A SMOOTH LEVEL SURFACE. EXERCISE CARE TO AVOID RAISING THE NAP OF PAPER

F. DO NOT PERFORM PAINTING AND OTHER FINISHING WORK UNDER CONDITIONS UNSUITABLE FOR EXECUTION OF PAINTING WORK. AIR SHALL BE FREE FROM DUST AND DIRT TO PREVENT LODGING OF FOREIGN MATTER IN FRESH PAINT. FLOORS MUST BE BROOM CLEAN BEFORE PAINTING IS STARTED.

G. PAINT DESIGNATIONS INDICATE COLOR ONLY, REFER TO SPECIFICATION FOR FINISH TYPE.

H. EDGES OF PAINT ADJOINING OTHER COLORS OR MATERIALS TO BE SHARP AND CLEAN WITHOUT OVERLAP.

I. EXAMINE SURFACES TO RECEIVE PAINT CAREFULLY FOR DEFECTS. DO NOT PROCEED WITH WORK UNTIL DEFECTS ARE CORRECTED.

J. WHENEVER NECESSARY TO OBTAIN REQUIRED RESULTS, REFINISH AN ENTIRE WALL RATHER THAN SPOT FINISHING WHERE A PORTION OF THE FINISH HAS BEEN DAMAGED OR IS UNSATISFACTORY.

K. PREPARE FLOOR SURFACES INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING:
   A. PREPARE/PROPERLY REPAIR AND PATCH SUBFLOORS TO A SMOOTH AND LEVEL FINISH.
   B. FLASH PATCH AS REQUIRED, READY TO RECEIVE NEW FINISH.

L. PROVIDE SELF LEVELING TROWELABLE UNDERLAYMENT WHERE REQUIRED TO OBTAIN FINISH MANUFACTURER'S REQUIRED SUBFLOOR CONDITION.

M. FOLLOW THE CARPET AND RUG INSTITUTE METHODS OF INSTALLATION.

N. INSTALL TILE PER THE TILE COUNCIL OF NORTH AMERICA'S INSTALLATION SPECIFICATIONS.

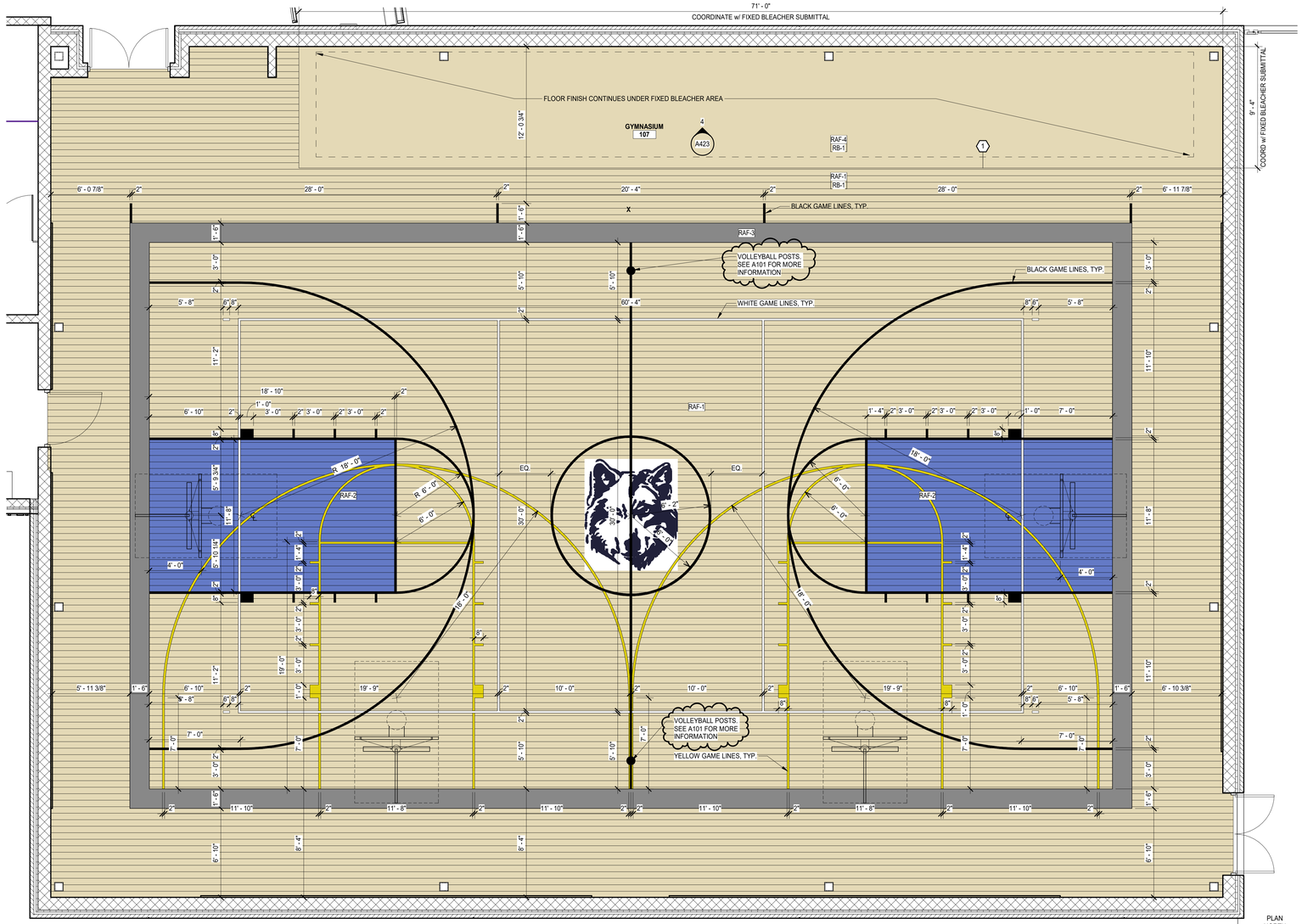
O. PROVIDE THE REQUIRED TRANSITIONS BASED ON TYPES IDENTIFIED ON DRAWINGS AT EACH FINISH TRANSITION LOCATION

P. CENTER FLOOR MATERIAL TRANSITIONS ON DOOR ABOVE.

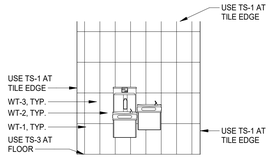
Q. FINISHED FLOORS EXTEND INTO TOE SPACES, CLOSETS, DOOR REVEALS AND SIMILAR OPENINGS.

R. REFER TO REFLECTED CEILING PLANS FOR CEILING FINISHES.

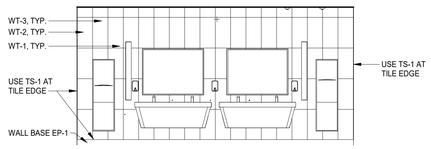
S. REFER TO ELEVATIONS FOR MILLWORK FINISHES.



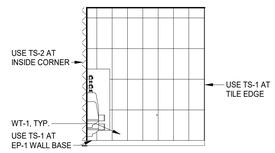
1 STRIPING PLAN
SCALE : 1/4" = 1'-0"



5 TILE PATTERN AT DRINKING FOUNTAIN
SCALE : 1/4" = 1'-0"



4 TILE PATTERN ELEVATION
SCALE : 1/4" = 1'-0"



3 TILE PATTERN ELEVATION
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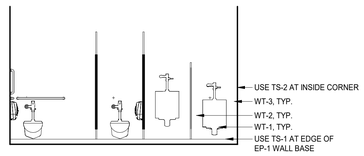

2 TILE PATTERN ELEVATION
SCALE : 1/4" = 1'-0"

PLAN NORTH

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PROJECT MANAGER: B HUYLER
DISCIPLINE LEAD:
DESIGNER: J TRIERWEILER
REVIEWER:
DATE ISSUED: 12/05/25
PROJECT NUMBER: 25009229A

SHEET NAME:
ENLARGED FINISH PLAN AND DETAILS

DRAWING NUMBER:
A142

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EXTERIOR MATERIALS SCHEDULE

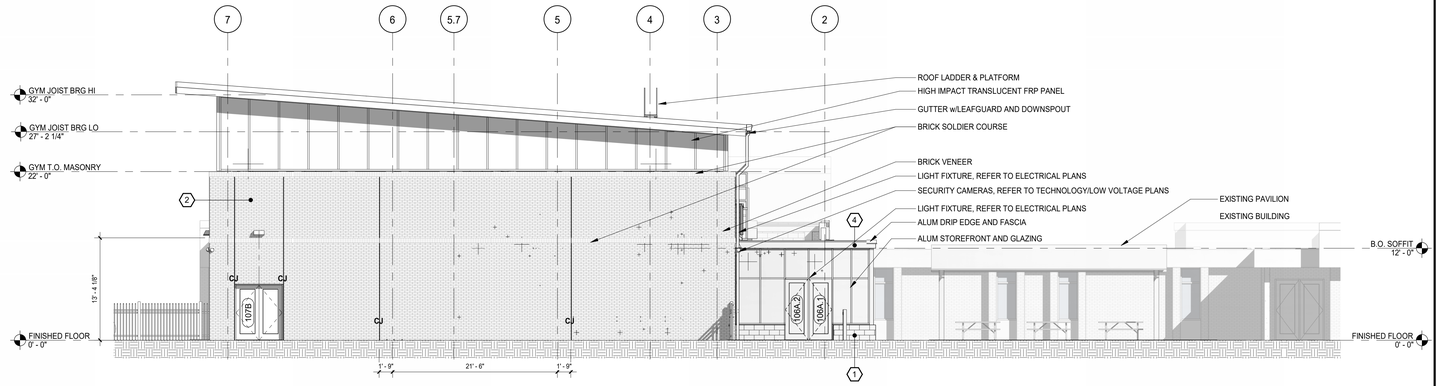
1 BURNISHED CMU VENEER; GRAND BLANC CEMENT PRODUCTS, GREYSTONE WHITE

2 BRICK VENEER; COLOR TBD; ALLOWANCE OF $1.15 EACH, DELIVERED AND UNLOADED AT THE SITE ($7.88 PER SQUARE FOOT)

3 FORMED METAL WALL PANELS; MORIN MATRIX SERIES (REFER TO A202 FOR LAYOUT), COLOR TBD

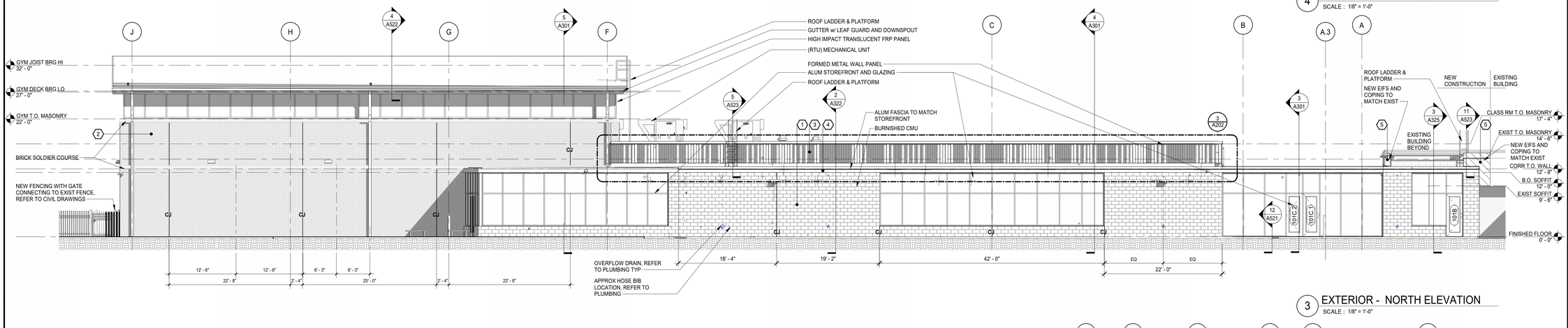
4 METAL COMPOSITE MATERIAL (MCM) WALL PANELS; ALUCOBOND 4MM, COLOR TBD

5 EXTERIOR INSULATION FINISH SYSTEM (EIFS) TO MATCH EXISTING



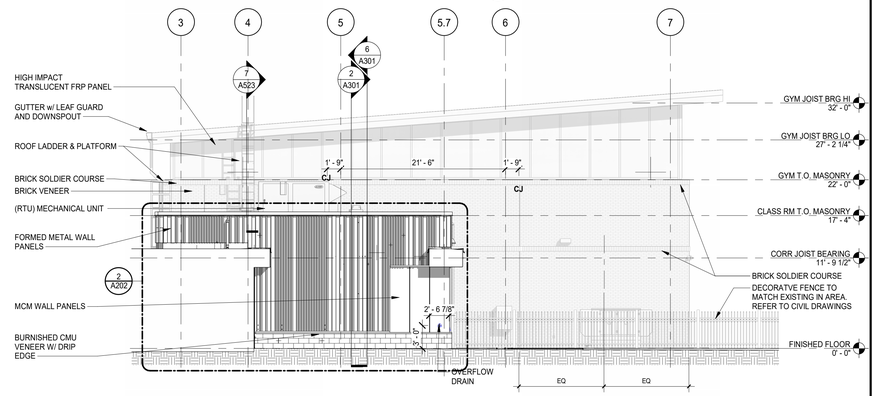
4 EXTERIOR - EAST ELEVATION

SCALE : 1/8" = 1'-0"



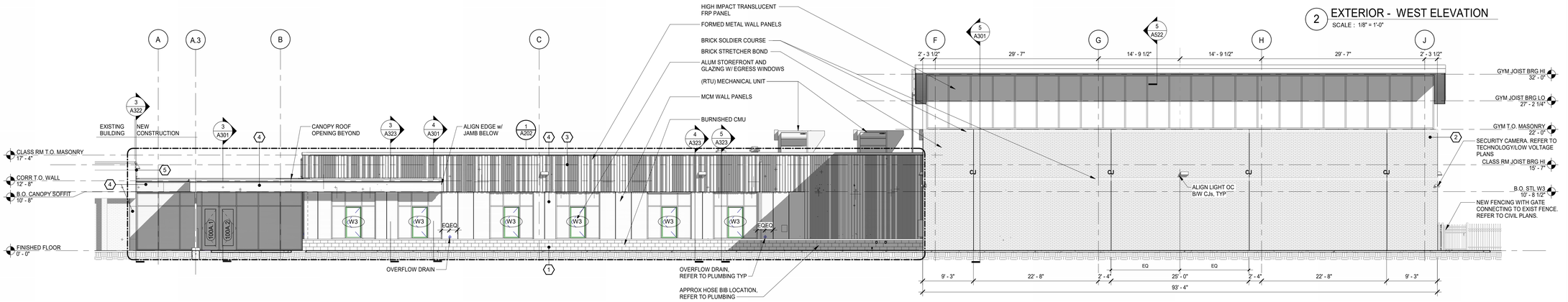
3 EXTERIOR - NORTH ELEVATION

SCALE : 1/8" = 1'-0"



2 EXTERIOR - WEST ELEVATION

SCALE : 1/8" = 1'-0"



1 EXTERIOR - SOUTH ELEVATION

SCALE : 1/8" = 1'-0"

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SHEET NAME:

EXTERIOR ELEVATIONS

DRAWING NUMBER:

A201

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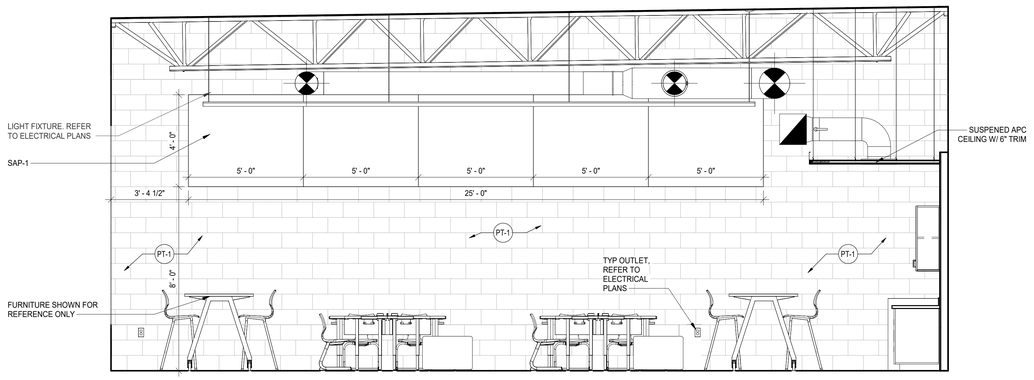
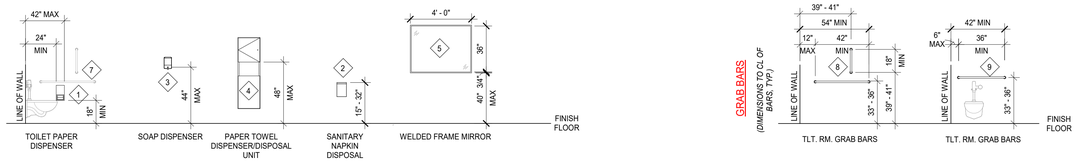
ARCH D 24x36

TOILET ACCESSORIES SCHEDULE				
TAG	MANUFACTURER	MODEL	DESCRIPTION	COMMENTS
1	--	--	BATH TISSUE DISPENSER	PROVIDED BY OWNER, INSTALLED BY G.C.
2	BOBRICK	B-270	SURFACE MOUNTED SANITARY NAPKIN DISPOSAL	PROVIDED & INSTALLED BY G.C.
3	--	--	SOAP DISPENSER	PROVIDED BY OWNER, INSTALLED BY G.C.
4	--	--	RECESSED CONVERTIBLE PAPER TOWL DISPENSER AND WASTE RECEPTACLE	PROVIDED BY OWNER, INSTALLED BY G.C.
5	BOBRICK	B-290 CUSTOM	36x48 CUSTOM MIRROR	PROVIDED & INSTALLED BY G.C.
7	BOBRICK	B-6806 X 42	42" HORIZONTAL GRAB BAR	PROVIDED & INSTALLED BY G.C.
8	BOBRICK	B-6806 X 18	18" VERTICAL GRAB BAR	PROVIDED & INSTALLED BY G.C.
9	BOBRICK	B-6806 X 36	36" HORIZONTAL GRAB BAR	PROVIDED & INSTALLED BY G.C.



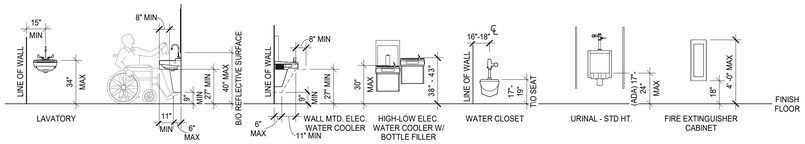
10 CLASSROOM A - WEST ELEVATION (OPP B AND C)
SCALE : 3/8" = 1'-0"

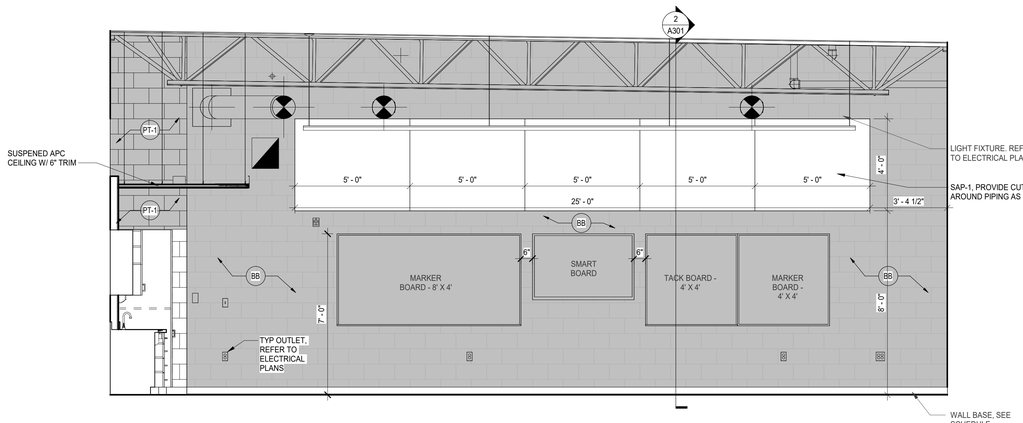
ACCESSORIES



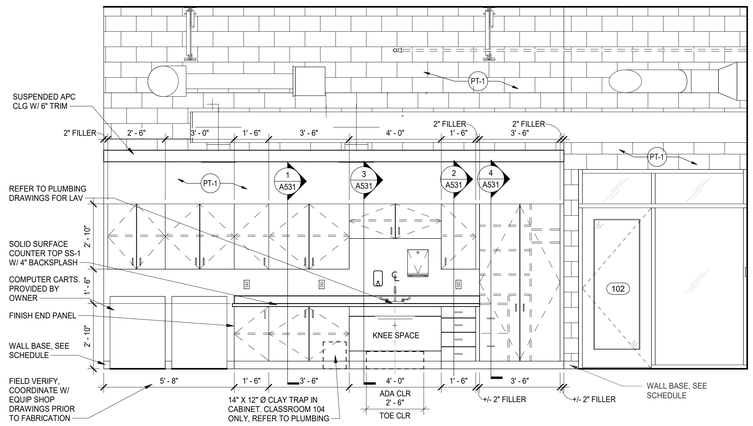
GRAB BARS (DIMENSIONS TO CL OF BARS, TYP.)

FIXTURE DIMENSIONS

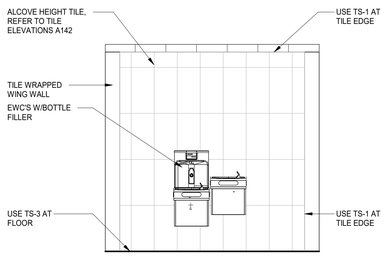




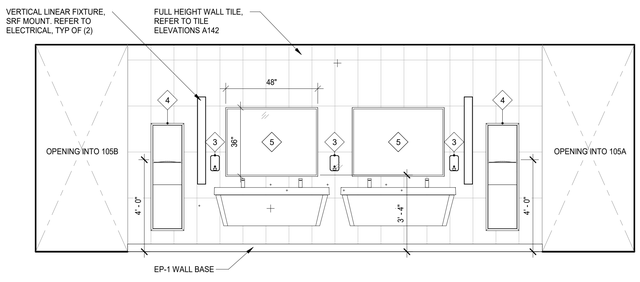
9 CLASSROOM A - EAST ELEVATION (OPP B AND C)
SCALE : 3/8" = 1'-0"



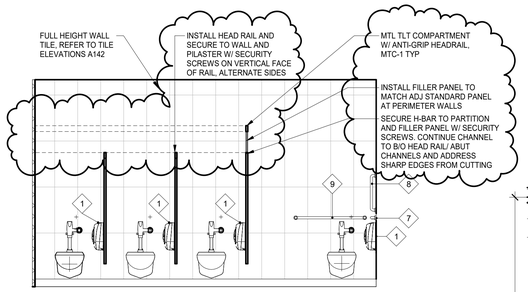
8 CLASSROOM A - NORTH ELEVATION (OPP B AND C)
SCALE : 3/8" = 1'-0"



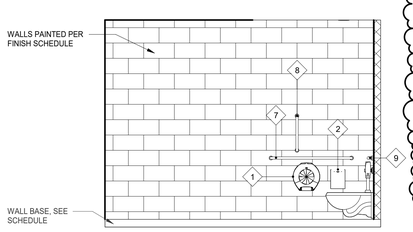
7 CORRIDOR 101 - DRINKING FOUNTAIN
SCALE : 3/8" = 1'-0"



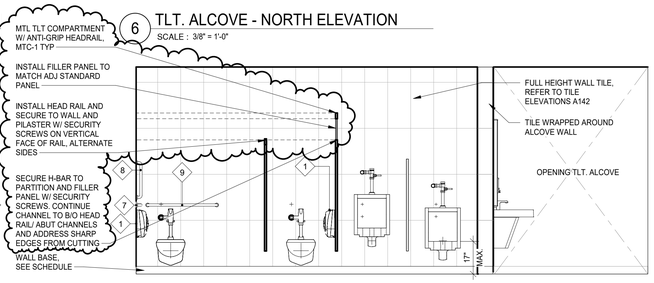
6 TLT. ALCOVE - NORTH ELEVATION
SCALE : 3/8" = 1'-0"



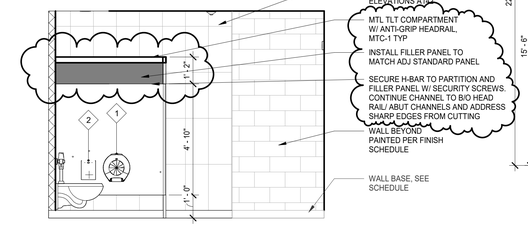
5 WOMENS TLT. 105A - EAST ELEVATION
SCALE : 3/8" = 1'-0"



4 MENS TLT. 105B - SOUTH ELEVATION
SCALE : 3/8" = 1'-0"



3 MENS TLT. 105B - WEST ELEVATION
SCALE : 3/8" = 1'-0"



2 MENS TLT. 105B - NORTH ELEVATION
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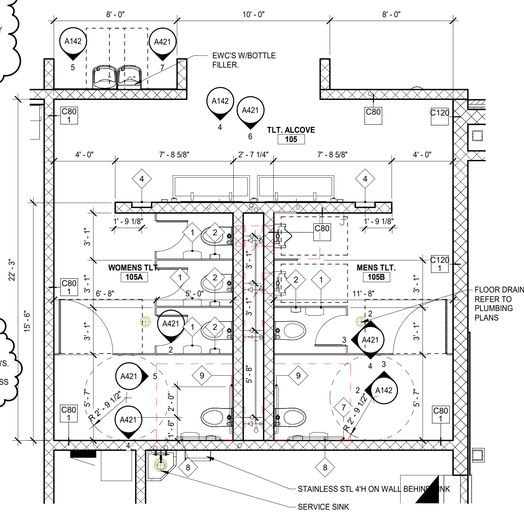

1 FIRST FLOOR PLAN - RESTROOMS
SCALE : 1/4" = 1'-0"

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REV	DATE	DESCRIPTION
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

KEY PLAN

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

Colliers Engineering & Design
GRAND RAPIDS
560 5th St. NW
Suite 305
Grand Rapids, MI 49504
Phone: 616.827.4270
Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER	DISCIPLINE LEAD:
DESIGNER: S KHUMALO	REVIEWER:
DATE ISSUED: 12/05/25	PROJECT NUMBER: 25009229A

SHEET NAME:

INTERIOR ELEVATIONS

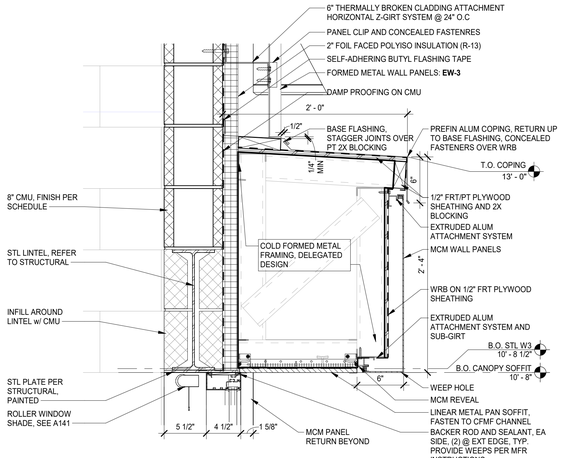
DRAWING NUMBER:

A421

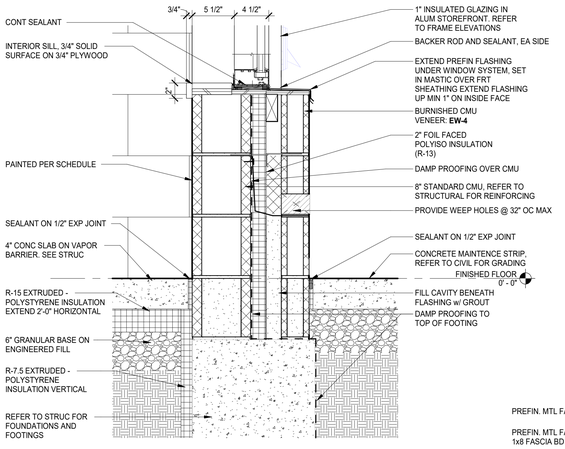
NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

12/5/2025 12:51:07 PM

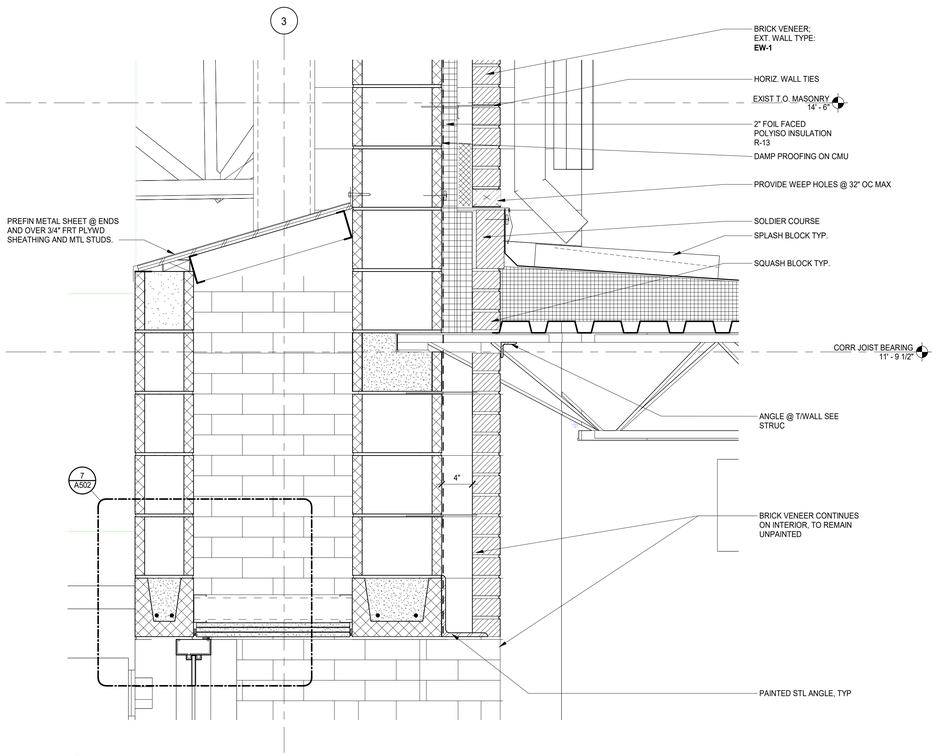
ARCH D 24x36



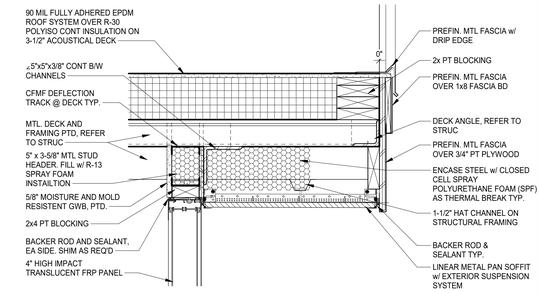
10 HEAD - W3 w/ CANOPY
SCALE : 1 1/2" = 1'-0"



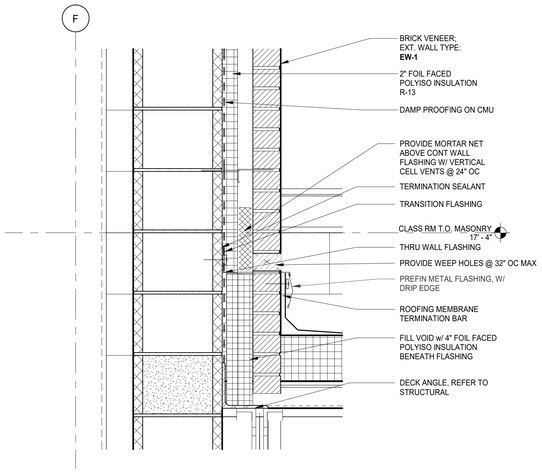
9 FDN - CLASS EXT - W3
SCALE : 1 1/2" = 1'-0"



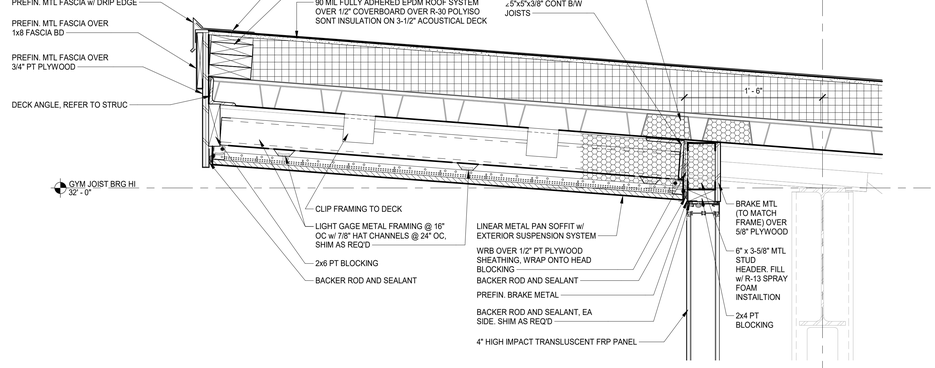
8 ROOF - GYM/CORR
SCALE : 1 1/2" = 1'-0"



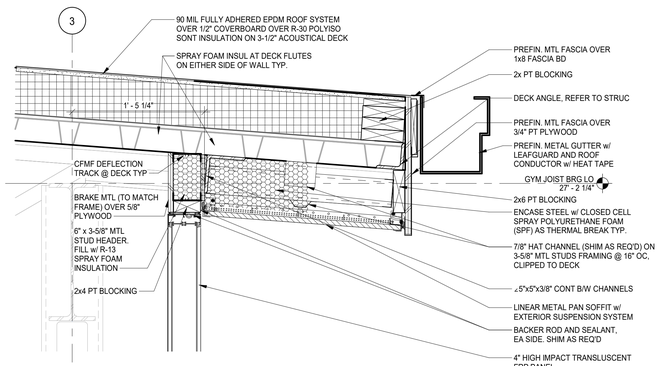
7 ROOF - GYM (E/W)
SCALE : 1 1/2" = 1'-0"



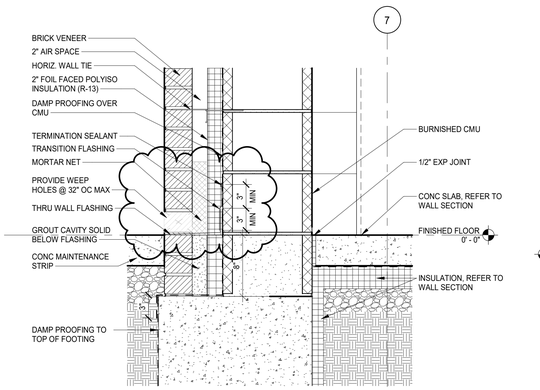
6 ROOF - GYM/CR
SCALE : 1 1/2" = 1'-0"



5 ROOF - GYM (SOUTH)
SCALE : 1 1/2" = 1'-0"



4 ROOF - GYM (NORTH)
SCALE : 1 1/2" = 1'-0"



3 FDN - GYM
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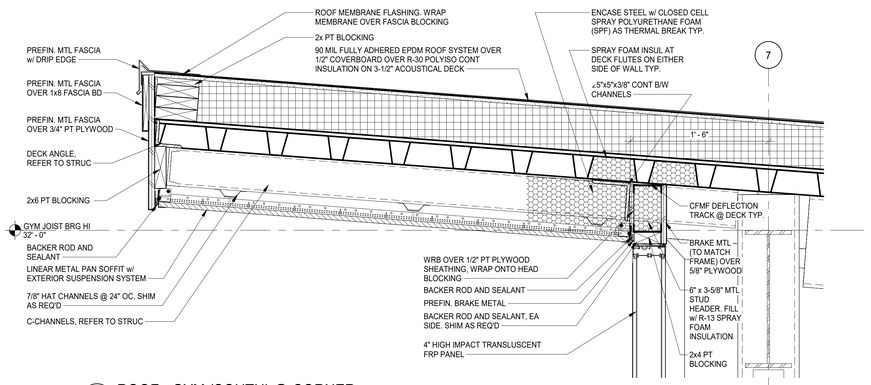
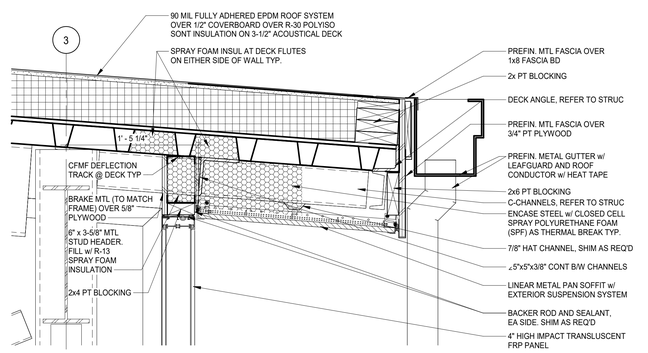


2 ROOF - GYM (SOUTH) @ CORNER
SCALE : 1 1/2" = 1'-0"



1 ROOF - GYM (NORTH) @ CORNER
SCALE : 1 1/2" = 1'-0"

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REV	DATE	DESCRIPTION
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

KEY PLAN

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

Colliers Engineering & Design
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Phone: 616.827.4270
Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER
DISCIPLINE LEAD:
DESIGNER:
REVIEWER:
DATE ISSUED: 12/05/25
PROJECT NUMBER: 25009229A
SHEET NAME:

SECTION DETAILS

DRAWING NUMBER:

A522

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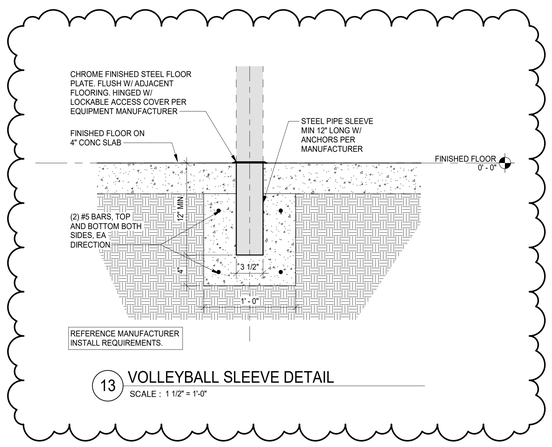
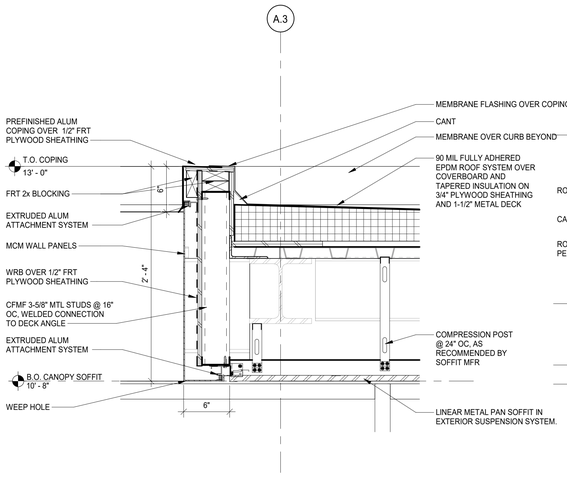
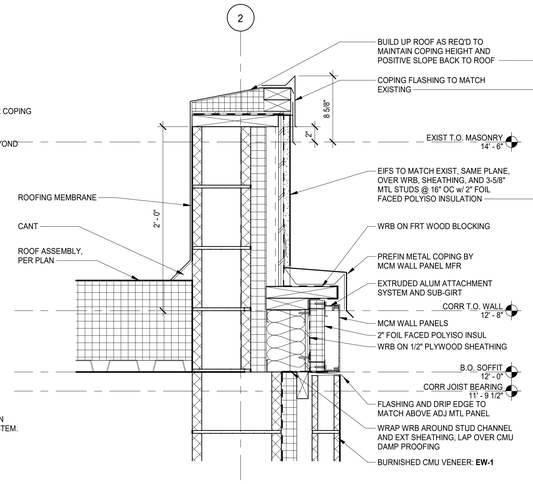


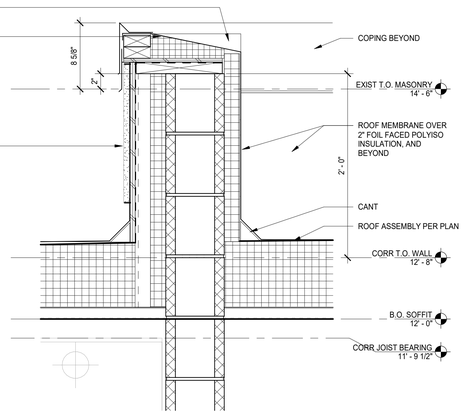
13 VOLLEYBALL SLEEVE DETAIL
SCALE : 1 1/2" = 1'-0"



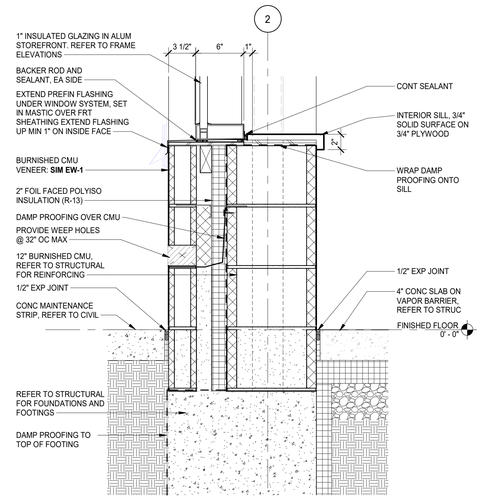
12 CANOPY - WEST SIDE DTL
SCALE : 1 1/2" = 1'-0"



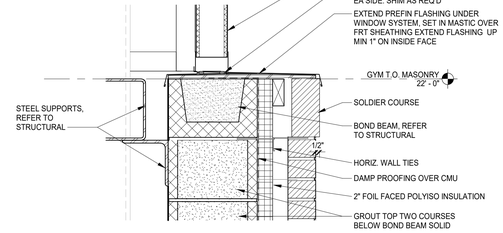
11 ROOF - NORTH WING DTL
SCALE : 1 1/2" = 1'-0"



10 ROOF - SOUTH WING DTL
SCALE : 1 1/2" = 1'-0"

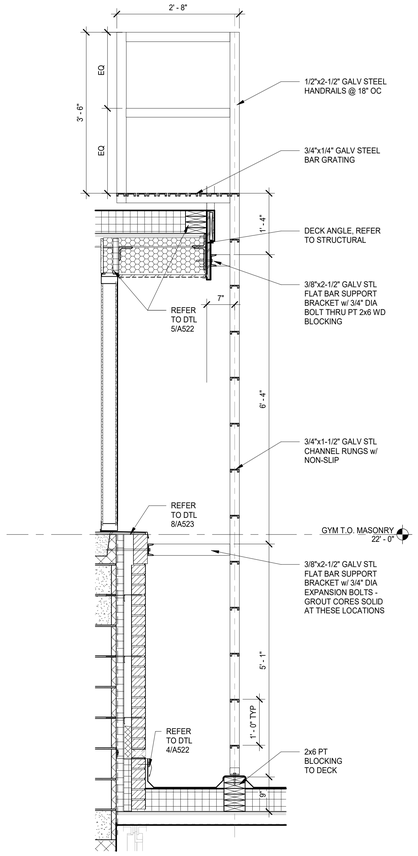


9 FDN - CORR EXT - W1 & W2
SCALE : 1 1/2" = 1'-0"

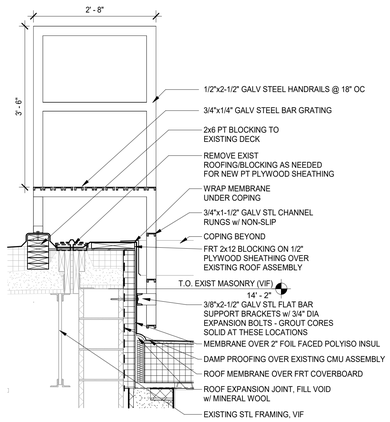


8 GYM - FRP SILL
SCALE : 1 1/2" = 1'-0"

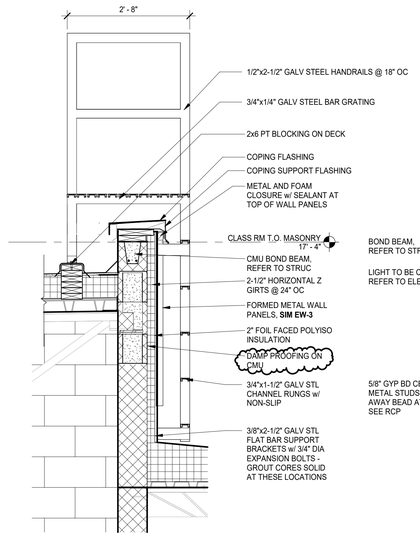
3 SECTION DETAIL @ VESTIBULE 106
SCALE : 1 1/2" = 1'-0"



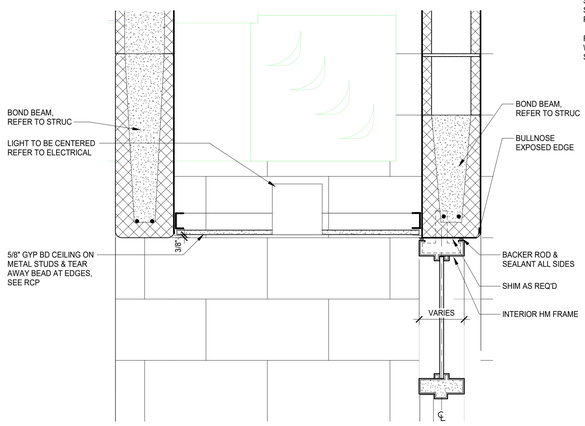
7 GYM ROOF LADDER DETAIL
SCALE : 3/4" = 1'-0"



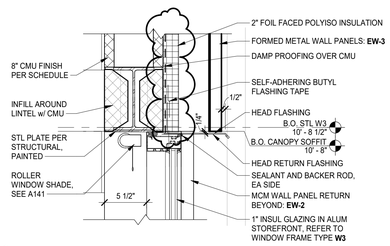
6 ROOF LADDER @ CORR/EXIST
SCALE : 3/4" = 1'-0"



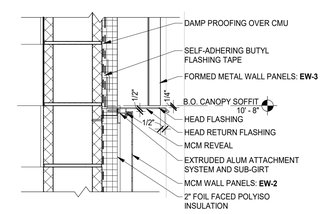
5 CLASSROOM ROOF LADDER DETAIL
SCALE : 3/4" = 1'-0"



4 TYP HEAD DETAIL @ CLASSROOMS
SCALE : 1 1/2" = 1'-0"



2 HEAD - W3
SCALE : 1 1/2" = 1'-0"



1 EW-3/EW-2 VERTICAL TRANSITION
SCALE : 1 1/2" = 1'-0"

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REV	DATE	DESCRIPTION
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

KEY PLAN

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

Colliers Engineering & Design
GRAND RAPIDS
560 5th St. NW
Suite 305
Grand Rapids, MI 49504
Phone: 616.827.4270
Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER
DISCIPLINE LEAD:
DESIGNER:
REVIEWER:
DATE ISSUED: 12/05/25
PROJECT NUMBER: 25009229A
SHEET NAME: SECTION DETAILS
DRAWING NUMBER: A523

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

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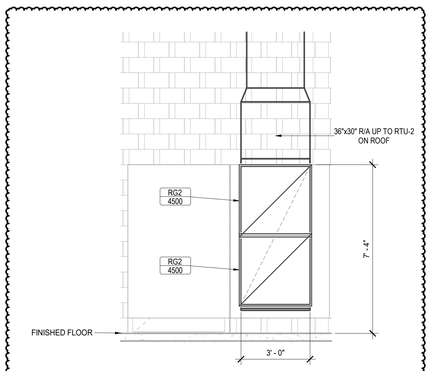
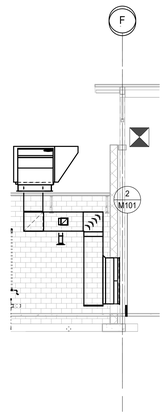
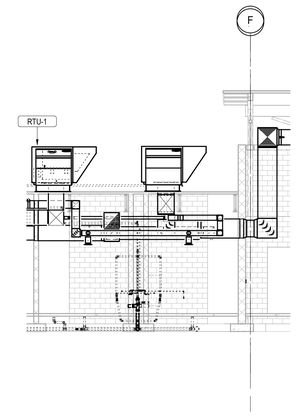


2 RG2 RETURN GRILLES - SECTION
SCALE : 3/8" = 1'-0"



3 RTU-2 RETURN AIR - SECTION
SCALE : 1/8" = 1'-0"



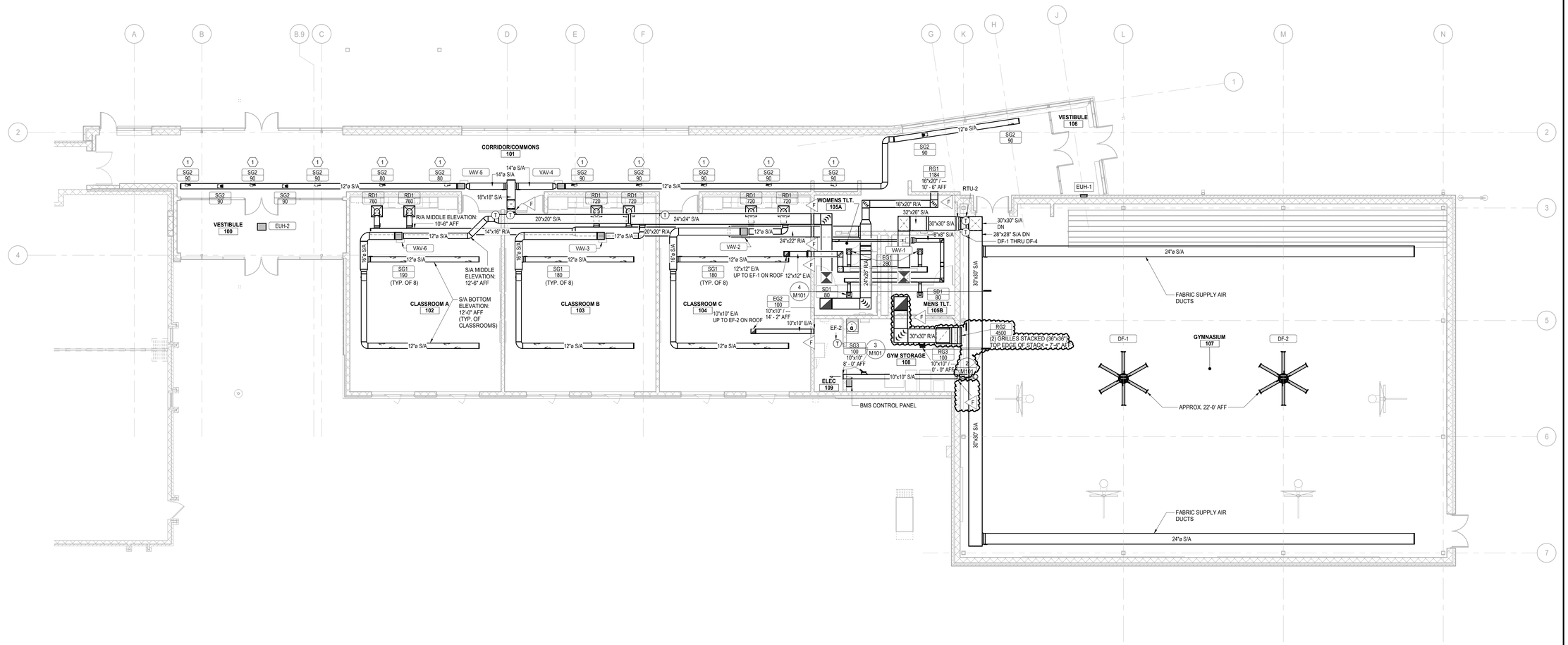
4 RTU-1 & 2 - SECTION
SCALE : 1/8" = 1'-0"

GENERAL NOTES

A. NEW MECHANICAL EQUIPMENT SHALL BE INTEGRATED WITH AND CONTROLLED BY THE EXISTING BUILDING BMS. CONTRACTOR SHALL COORDINATE WITH THE BMS VENDOR TO CONFIRM FULL FUNCTIONALITY OF ALL CONTROL SEQUENCES, ALARMS, MONITORING, ETC. PER SPECIFICATION SECTION 23.09.93.
B. PAINT ALL EXPOSED METAL DUCTWORK IN CLASSROOMS AND CORRIDOR. REFERENCE ARCHITECTURAL SHEET A141 FOR COLOR.
C. PAINT ALL EXPOSED METAL DUCTWORK IN GYMNASIUM. REFERENCE ARCHITECTURAL SHEET A141 FOR COLOR.

KEYNOTES (X)

1. INSTALL DUCT-MOUNTED SUPPLY GRILLE AT 45 DEGREE DOWNWARD ANGLE FOR AIR TO BLOW AT BASE OF WINDOWS.



1 1ST FLOOR HVAC PLAN
SCALE : 1/8" = 1'-0"

12/4/2025 4:25:44 PM

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REV	DATE	DESCRIPTION
5	11/07/25	BIDS & PERMITS
6	12/05/25	ADDENDUM #2

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ENGINEERING
FIRM LICENSE # NLP000605

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Suite 305
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Phone: 616.827.4270
Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER
DISCIPLINE LEAD:
DESIGNER:
REVIEWER:
DATE ISSUED: 09/09/2025
PROJECT NUMBER: 25009229A
SHEET NAME: 1ST FLOOR HVAC PLAN
DRAWING NUMBER: M101

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

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ROOFTOP HEAT PUMP SCHEDULE

ID	MAKE	MODEL	ARRANGEMENT	OA FLOW (CFM)	FAN						NOMINAL CAP	COOLING						HEATING	EMERGENCY GAS HEAT CAP	HEATING		AMBIENT		EFFICIENCY		FILTER	UNIT WEIGHT	ELECTRICAL					REMARKS
					SA FLOW (CFM)	ESP (IN. W.C.)	DRIVE TYPE	MOTOR				CAP		AIRSIDE				HTG CAP		AIRSIDE		SUMMER (db/wb)	WINTER (db)	EER	IEER			FLA	MCA	MOCP	VOLT	PH	
								QTY	RPM	ECM		TOTAL	SENSIBLE	EAT (db)	EAT (wb)	LAT (db)	LAT (wb)			EAT (db)-	LAT (db)-											
RTU-1	AAON	RN-018-3-0	DOWNFLOW	1500	5900	1.5	DIRECT	1	1537	YES	18 TONS	201.6 TMBH	148.3 SMBH	78.6 °F	65.0 °F	54.4 °F	53.0 °F	88.4 MBH	328.1 MBH	53.7 °F	106.1 °F	89.3 °F / 72.9 °F	0 °F	11.56	16.86	MERV-8	2969 LBS	86	93	110	208	3	1, 2, 4, 5, 6
RTU-2	AAON	RN-020-3-0	DOWNFLOW	3000	9000	0.5	DIRECT	1	1283	YES	20 TONS	250.5 TMBH	200.9 SMBH	78.6 °F	66.6 °F	54.4 °F	53.0 °F	114.0 MBH	328.1 MBH	53.7 °F	97.1 °F	89.3 °F / 72.9 °F	0 °F	11.37	16.46	MERV-8	3325 LBS	112	118	125	208	3	1, 3, 4, 5, 6, 7

NOTES:
1. PROVIDE UNIT-MOUNTED DISCONNECT SWITCH.
2. VARIABLE VOLUME CONTROL.
3. CONSTANT VOLUME CONTROL.
4. PROVIDE FULL ECONOMIZER & POWER EXHAUST.
5. PROVIDE BACNET CONTROL INTERFACE.
6. PROVIDE AND INSTALL GAS PRESSURE SERVICE REGULATOR WITH MAX OUTLET PRESSURE OF 10.5" W.C.
7. PROVIDE AND INSTALL DUCT SMOKE DETECTORS AT RETURN AND SUPPLY AIR DUCT CONNECTIONS.

EXHAUST FAN SCHEDULE

TAG	LOCATION NAME	MANUFACTURER	MODEL NO.	AIRFLOW (CFM)	ESP (IN W.C.)	FAN RPM	DRIVE TYPE	MOTOR QTY	MOTOR POWER	MOTOR RPM	FLA	MCA	MOCP	VOLTS/PH/HZ	REMARKS
EF-1	ROOF	GREENHECK	G-100-VG	600	0.375	1073	DIRECT	1	1/4	1073	3.8	4.8	15	120/1/60	PROVIDE 14" ROOF CURB WITH GRAVITY BACKDRAFT DAMPER
EF-2	ROOF	GREENHECK	G-060	100	0.375	1050	DIRECT	1	1/20	1050	1.3	1.6	15	120/1/60	PROVIDE 14" ROOF CURB WITH GRAVITY BACKDRAFT DAMPER

NOTES:
1. EF-1 TO BE INTERLOCKED WITH RESTROOM LIGHTING.

VARIABLE AIR VOLUME TERMINAL UNIT SCHEDULE

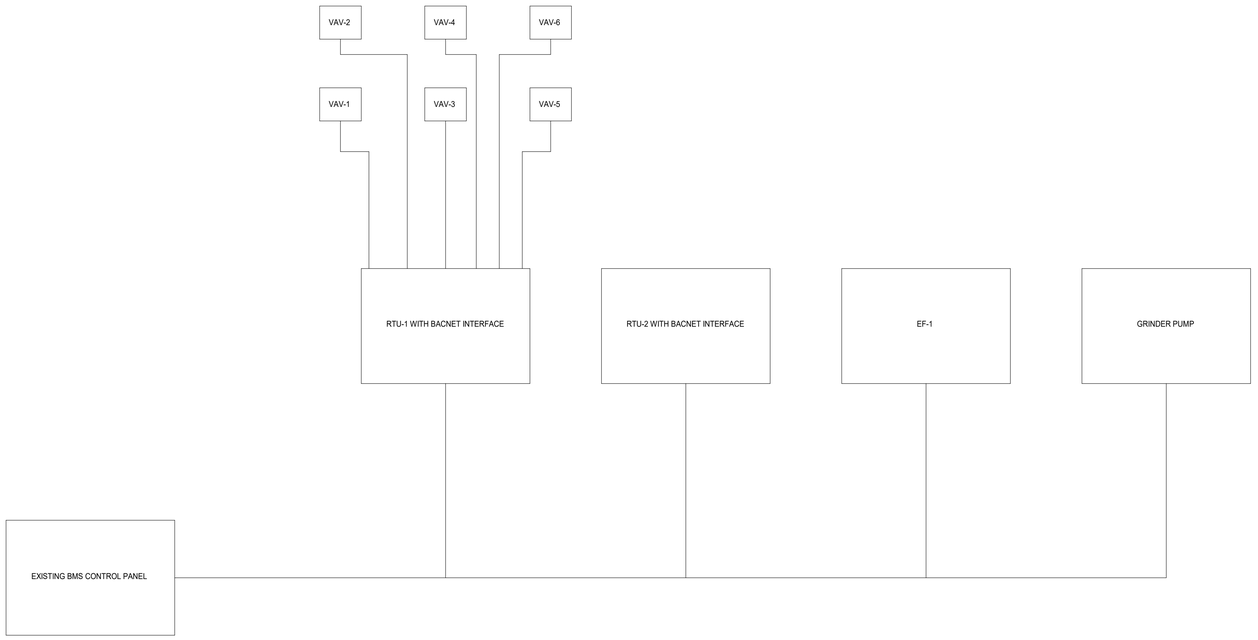
ID	LOCATION NAME	LOCATION NO.	MANUFACTURER	MODEL NO.	NECK SIZE	TYPE	PRIMARY AIRFLOW MAX	PRIMARY AIRFLOW MIN	EXTERIOR ZONE	NC	UNIT WEIGHT	INTERLOCK ID	REMARKS
VAV-1	RESTROOMS	105A/B	TITUS	DESV	5"	SINGLE DUCT	160	50	Yes	0	37.00 lbf		
VAV-2	CLASSROOM	104	TITUS	DESV	12"	SINGLE DUCT	1440	435	Yes	0	53.00 lbf		
VAV-3	CLASSROOM	103	TITUS	DESV	12"	SINGLE DUCT	1440	435	Yes	0	53.00 lbf		
VAV-4	CORRIDOR (EAST)	101	TITUS	DESV	8"	SINGLE DUCT	630	190	Yes	0	39.00 lbf		
VAV-5	CORRIDOR (WEST)	101	TITUS	DESV	8"	SINGLE DUCT	610	185	Yes	0	39.00 lbf		
VAV-6	CLASSROOM	102	TITUS	DESV	12"	SINGLE DUCT	1520	460	Yes	0	53.00 lbf		

GRILLES, REGISTERS AND DIFFUSERS SCHEDULE

ID	DESCRIPTION	MANUFACTURER	MODEL	MATERIAL	FINISH	SYSTEM	DAMPER	NOTES
EG1	PLAQUE FACE DIFFUSER	Titus	OMNI-08-1-1 2x12-26	STEEL	WHITE	E/A	NO	
EG2	LOUVERED GRILLE	TITUS	350FL	STEEL	WHITE	E/A	NO	
RD1	PLAQUE FACE DIFFUSER	TITUS	OMNI	STEEL	WHITE	R/A	NO	
RG1	LOUVERED GRILLE	TITUS	350FL	STEEL	WHITE	R/A	NO	
RG2	LOUVERED GRILLE	TITUS	33RL	STEEL	WHITE	R/A	NO	HEAVY DUTY
RG3	LOUVERED GRILLE	TITUS	350FS	STEEL	WHITE	R/A	NO	
SD1	PLAQUE FACE DIFFUSER	Titus	OMNI-06-1-1 2x12-26	STEEL	WHITE	S/A	NO	
SG1	DOUBLE DEFLECTION GRILLE	TITUS	S300FS	ALUMINUM	WHITE	S/A	YES	
SG2	DOUBLE DEFLECTION GRILLE	TITUS	S300FS	ALUMINUM	WHITE	S/A	YES	
SG3	DOUBLE DEFLECTION GRILLE	TITUS	300FL	STEEL	WHITE	S/A	YES	

CABINET WALL HEATER SCHEDULE

TAG	MANUFACTURER	MODEL	ELECTRICAL KW	ELECTRICAL FLA	ELECTRICAL VOLTS/PH/HZ	NOTES
EUH-1	INDEECO	933IW-4506-S	4.8	13.3	208/3/60	WALL MOUNT, INTEGRAL CONTROLS
EUH-2	INDEECO	931IF4804-N	4.8	17.3	208/1/60	CEILING MOUNT, INTEGRAL CONTROLS



1 HVAC CONTROLS ARCHITECTURE

SEQUENCE OF OPERATIONS

RTU-1:

RTU-1 WILL OPERATE AS A VARIABLE VOLUME PACKAGED ROOFTOP UNIT. UPON A CALL FOR COOLING, THE UNIT WILL OPERATE ON ITS OWN INTERNAL CONTROLS TO MODULATE COOLING AND AIRFLOW. COOLING WILL MODULATE TO MAINTAIN SUPPLY AIR TEMPERATURE TO THE SPACE. AIRFLOW WILL MODULATE BASED ON MAINTAINING DUCT STATIC PRESSURE IN THE SUPPLY AIR DUCTWORK. THE VAV BOXES WILL MODULATE BASED ON THEIR RESPECTIVE ZONE THERMOSTATS FOR HEATING AND COOLING. UPON A CALL FOR HEATING, THE UNIT SHALL OPERATE ON ITS OWN INTERNAL CONTROLS AS A HEAT PUMP TO GENERATE HEATING AIR SUPPLY. WHEN THE DISCHARGE TEMPERATURE CANNOT BE SATISIFED BY THE HEAT PUMP, THE RTU'S GAS SUPPLY WILL SUPPLEMENT THE HEAT PUMP TO MAINTAIN TEMPERATURE. THE UNIT WILL UTILIZE ECONOMIZER MODE WHEN OUTDOOR AIR CONDITIONS ARE APPROPRIATE, BASED ON AN ENTHALPY SENSOR. FAILURE TO MAINTAIN TEMPERATURE IN THE SYSTEM OR TO MAINTAIN AIRFLOW WILL RESULT IN AN ALARM SENT TO THE BMS. UPON DETECTION OF SMOKE BY THE RETURN AND/OR SUPPLY AIR SMOKE DETECTOR, AN ALARM SHALL BE SENT TO THE BMS AND TO THE BUILDING FIRE ALARM CONTROL PANEL, AND WILL SHUT DOWN THE UNIT.

VAV BOXES:

THE VAV BOXES WILL OPERATE BASED ON THEIR OWN RESPECTIVE ZONE THERMOSTATS. VAV BOX DAMPERS WILL MODULATE TO MAINTAIN SETPOINT TEMPERATURE. FAILURE OF A VAV BOX TO MAINTAIN SPACE TEMPERATURE SETPOINT SHALL RESULT IN AN ALARM TO THE BMS.

RTU-2:

RTU-2 WILL OPERATE AS A CONSTANT VOLUME PACKAGED ROOFTOP UNIT. UPON A CALL FOR COOLING, THE UNIT WILL OPERATE ON ITS OWN INTERNAL CONTROLS TO MODULATE COOLING WITH CONSTANT AIRFLOW. COOLING WILL MODULATE TO MAINTAIN SUPPLY AIR TEMPERATURE TO THE SPACE. UPON A CALL FOR HEATING, THE UNIT SHALL OPERATE ON ITS OWN INTERNAL CONTROLS AS A HEAT PUMP TO GENERATE HEATING AIR SUPPLY. WHEN THE DISCHARGE TEMPERATURE CANNOT BE SATISIFED BY THE HEAT PUMP, THE RTU'S GAS SUPPLY WILL SUPPLEMENT THE HEAT PUMP TO MAINTAIN TEMPERATURE. THE UNIT WILL UTILIZE ECONOMIZER MODE WHEN OUTDOOR AIR CONDITIONS ARE APPROPRIATE, BASED ON AN ENTHALPY SENSOR. FAILURE TO MAINTAIN TEMPERATURE IN THE SYSTEM OR TO MAINTAIN AIRFLOW WILL RESULT IN AN ALARM SENT TO THE BMS. UPON DETECTION OF SMOKE BY THE RETURN AND/OR SUPPLY AIR SMOKE DETECTOR, AN ALARM SHALL BE SENT TO THE BMS AND TO THE BUILDING FIRE ALARM CONTROL PANEL, AND WILL SHUT DOWN THE UNIT.

EF-1:

EF-1 WILL BE INTERLOCKED ELECTRICALLY WITH OPERATION OF THE RESTROOM LIGHTS. A CURRENT SENSOR WILL MONITOR CURRENT AT THE EXHAUST FAN. FAN FAILURE WILL CAUSE AN ALARM TO BE SENT TO THE BMS.

EF-2:

EF-2 WILL OPERATE BASED ON A WALL-MOUNTED THERMOSTAT IN THE ELECTRICAL ROOM. A CURRENT SENSOR WILL MONITOR CURRENT AT THE EXHAUST FAN. FAN FAILURE WILL CAUSE AN ALARM TO BE SENT TO THE BMS.

GRINDER PUMP:

THE GRINDER PUMP (REFER TO SITE CIVIL DRAWINGS) WILL BE MONITORED FOR STATUS WITH CONNECTION TO THE GRINDER PUMP CONTROL PANEL. PUMP STATUS WILL BE MONITORED BY THE BMS. FAILURE OF THE GRINDER PUMP WILL CAUSE AN ALARM TO BE SENT TO THE BMS.

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REV	DATE	DESCRIPTION
5	11/07/25	BIDS & PERMITS
6	12/05/25	ADDENDUM #2

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ENGINEERING
FIRM LICENSE # NLP000605

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GRAND RAPIDS
560 5th St. NW
Suite 305
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Phone: 616.827.4270

Colliers Engineering & Design, Architecture, Landscape Architecture, Surveying, CT P.C.

PROJECT MANAGER: B HUYLER
DISCIPLINE LEAD:
DESIGNER:
REVIEWER:
DATE ISSUED: 09/09/2025
PROJECT NUMBER: 25009229A
SHEET NAME: HVAC SCHEDULES
DRAWING NUMBER: M600

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

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ARCH D 24x36

POWER KEYNOTES

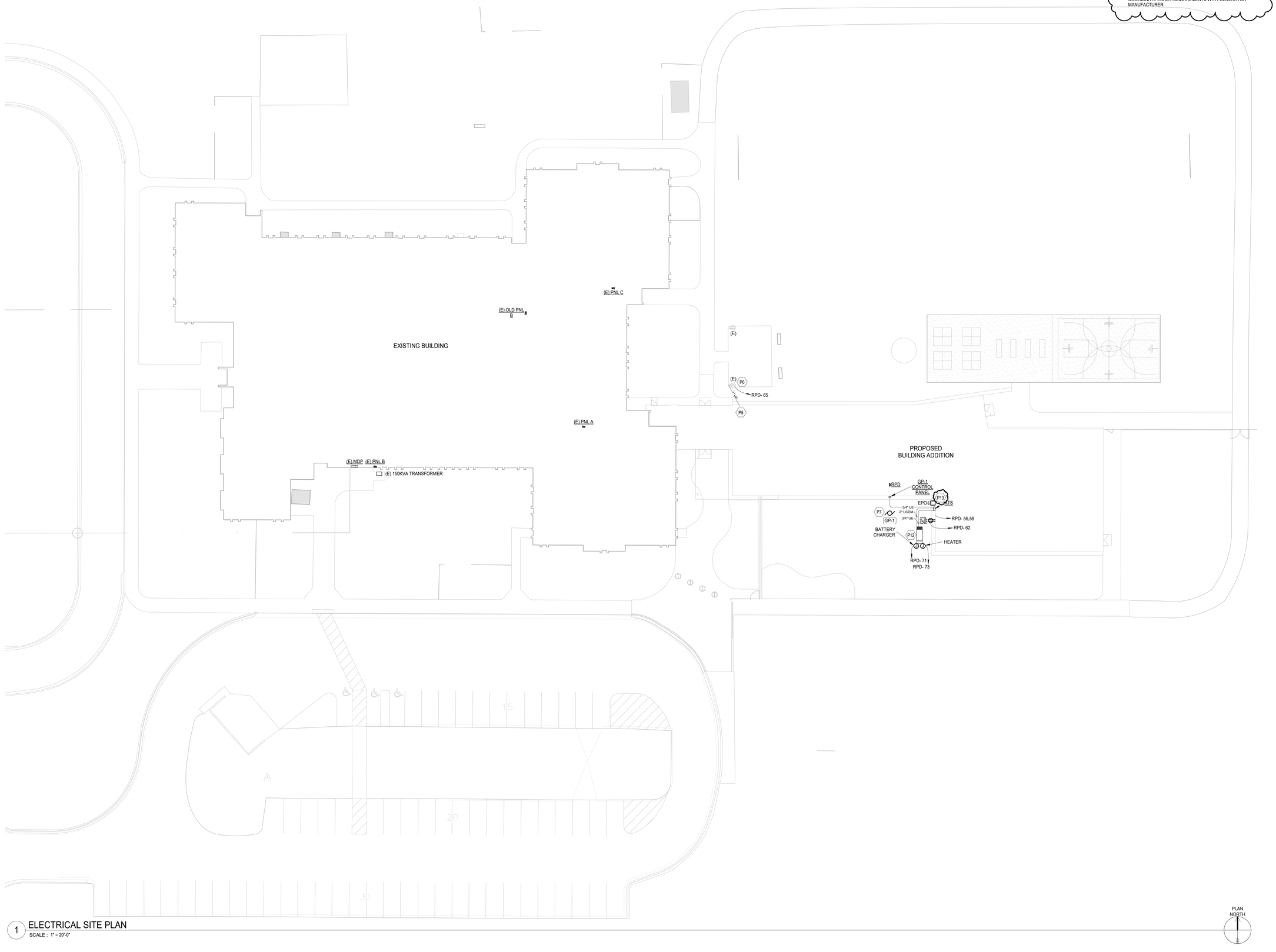
P5 ROUTE CONDUIT UNDERGROUND, TRANSITION INSIDE WALL, AND CONTINUE OVERHEAD TO PANEL.

P6 PROVIDE NEW CONDUIT AND CONDUCTORS TO EXISTING EQUIPMENT, CIRCUIT AS SHOW.

P7 COORDINATE WITH CIVIL DRAWINGS AND MANUFACTURER FOR FINAL LOCATION AND INSTALLATION REQUIREMENTS.

P12 ALTERNATE E-1: PROVIDE 25KW NATURAL GAS GENERATOR AND AUTOMATIC TRANSFER SWITCH.

P13 PROVIDE EMERGENCY POWER OFF (EPO) BUTTON FOR GENERATOR. COORDINATE EXACT REQUIREMENTS WITH GENERATOR MANUFACTURER.



1 ELECTRICAL SITE PLAN
SCALE : 1" = 20'-0"

PLAN NORTH

12/5/2025 7:17:51 AM

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REV	DATE	DESCRIPTION
1	07/23/25	SD OWNER REVIEW
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

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PROJECT MANAGER: B. HUYLER
DISCIPLINE LEAD: A. ROBINSON
DESIGNER: A. CARPENTER
REVIEWER: A. ROBINSON
DATE ISSUED: 11/07/25
PROJECT NUMBER: 25009229A

SHEET NAME:

ELECTRICAL SITE PLAN

DRAWING NUMBER:

ES002

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

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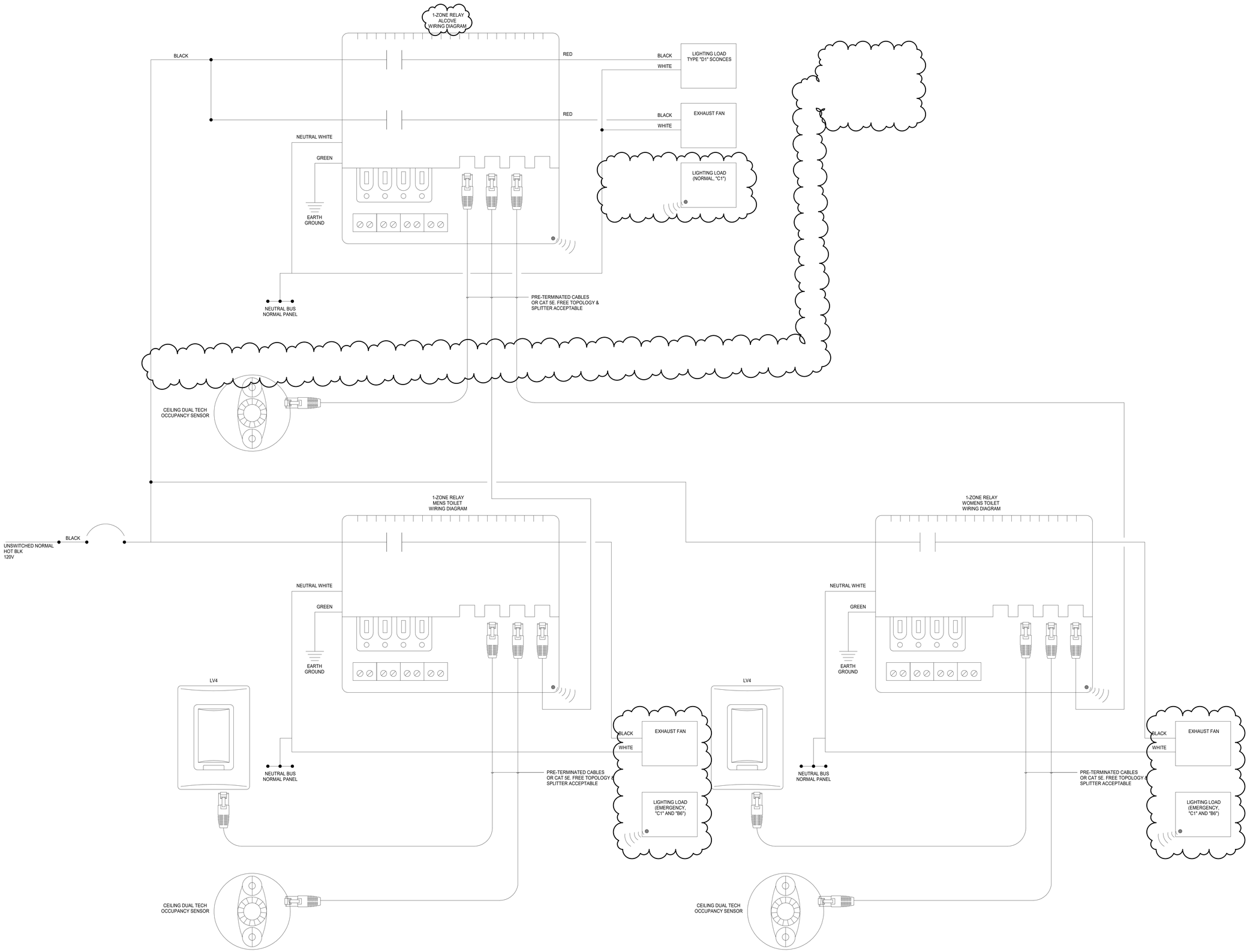

1 TOILET ROOM LIGHTING ROOM CONTROLLER DETAIL
SCALE : NTS

12/5/2025 7:17:52 AM

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REV	DATE	DESCRIPTION
1	07/23/25	SD OWNER REVIEW
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

Lansing School District

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

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B. HUYLER	A. ROBINSON
DESIGNER:	REVIEWER:
A. CARPENTER	A. ROBINSON
DATE ISSUED:	PROJECT NUMBER:
11/07/25	25009229A

SHEET NAME:

DETAILS

DRAWING NUMBER:

E602

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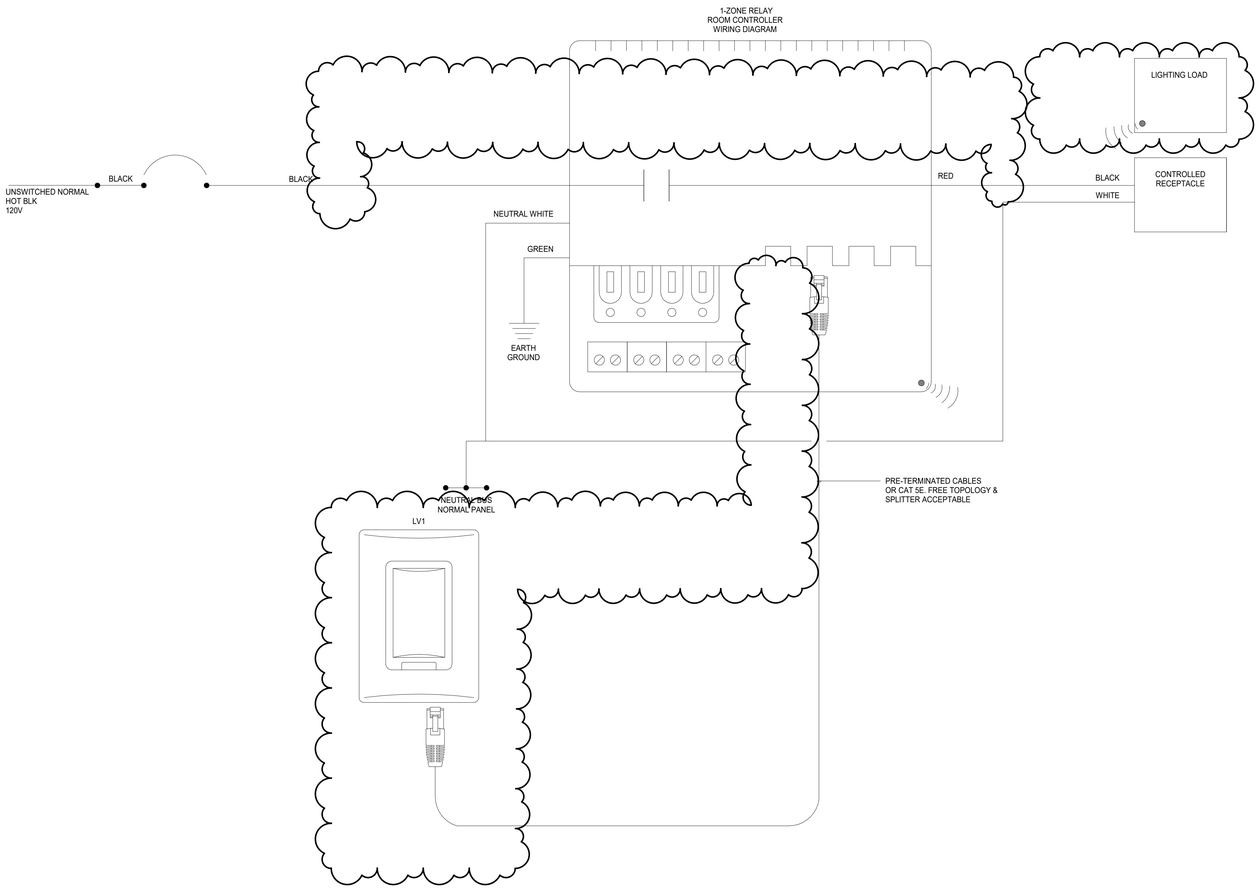

1 CLASSROOM LIGHTING ROOM CONTROLLER DETAIL
SCALE : NTS

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REV	DATE	DESCRIPTION
1	07/23/25	SD OWNER REVIEW
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

Lansing School District

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DESIGNER: A. CARPENTER
REVIEWER: A. ROBINSON
DATE ISSUED: 11/07/25
PROJECT NUMBER: 25009229A

SHEET NAME:

DETAILS

DRAWING NUMBER:

E603

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

ARCH D 24x36

LUMINAIRE SCHEDULE

TYPE	LAMP	MANUFACTURER	MODEL NUMBER	BALLAST/DRIVER	MOUNTING	INPUT WATTAGE	DESCRIPTION	NOTE
A1	15,000 LUMENS, 4000K, LED	METALUX	OHB-15SE-MFL-UNV-L840-CD-C3-WPS4-U-OHB-WG112	0-10V	SUSPENDED AT 23'-0" A.F.F.	93.0W	RECTANGULAR HIGHBAY. PROVIDE INTEGRAL SMART WIRELESS SYSTEM OCCUPANCY SENSOR, PHOTOCELL AND WIRE GUARD.	
		HE WILLIAMS	GS-2-L180/840-MD-(L150)-AVI-LVFA-PIR-ELB-DIM-UNV					
		LITHONIA	IBG-15000LM-SEF-AFL-GND-MVOLT-GZ10-40K-80CRI-WGX-NLTAIR2 RMS0D45-DWH					
		DAY-BRITE	FBZ-18L-840-UNV-SWZCSH-FBZ-WG2					
		COLUMBIA LIGHTING	PELA-840-L15-B-ED-U-PM-NXWHM					
A1EM	15,000 LUMENS, 4000K, LED	METALUX	OHB-15SE-MFL-UNV-L840-ETRD-CD-C3-WPS4-U-OHB-WG112	0-10V	SUSPENDED AT 23'-0" A.F.F.	93.0W	RECTANGULAR HIGHBAY. PROVIDE INTEGRAL SMART WIRELESS SYSTEM OCCUPANCY SENSOR, PHOTOCELL AND WIRE GUARD. PROVIDE INTEGRAL EMERGENCY TRANSFER DEVICE.	
		HE WILLIAMS	GS-2-L180/840-MD-(L150)-AVI-LVFA-PIR-ELB-DIM-UNV					
		LITHONIA	IBG-15000LM-SEF-AFL-GND-MVOLT-GZ10-40K-80CRI-ETS-WGX-NLTAIR2 RMS0D45-DWH					
		DAY-BRITE	FBZ-18L-840-UNV-GTD/E-SWZCSH-FBZ-WG2					
		COLUMBIA LIGHTING	PELA-840-L15-B-ED-U-PM-DTS-NXWHM					
B1	400 LUMENS/FOOT, 3500K, LED	AXIS	SCDSZ-400-80-35-FL-6-H8-XX-XX-UNV-DP-1-XX-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 10'-0" A.F.F.	25.5W	2-INCH WIDE, 6-FOOT PENDANT MOUNT LINEAR WITH ACCOUSTIC MATERIAL WRAP. PROVIDE INTEGRAL SMART WIRELESS SYSTEM OCCUPANCY SENSOR AND DAYLIGHT HARVESTING SENSOR.	1
		CORONET	LS1.STFU-6-35-LOW-UNV-DB-F/(XX)FH10-AC(X)-AV1.BWG-ACAS-NA-(XX)					
		FOCAL POINT	ASM1S-BW-8-400LF-935K-11-UNV-SP-J24-6FT0IN					
		LUX ILLUMINAIRE	HLCN 1.0-P-D-400-6-35K-9-UNV-S1-BAFF FIN-B-8-HC-24-SQ-BF-VDO					
		METALUMEN	S1-ACL-35K-6-RA-08-50-1-PA18-UNV-OD-VDO-90-FD					
B1EM	400 LUMENS/FOOT, 3500K, LED	AXIS	SCDSZ-400-80-35-FL-6-H8-XX-XX-UNV-DP-1-XX-B-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 10'-0" A.F.F.	25.5W	2-INCH WIDE, 6-FOOT PENDANT MOUNT LINEAR WITH ACCOUSTIC MATERIAL WRAP. PROVIDE INTEGRAL 10W EMERGENCY BATTERY BACKUP, SMART WIRELESS SYSTEM OCCUPANCY SENSOR, AND DAYLIGHT HARVESTING SENSOR..	1
		CORONET	LS1.STFU-6-35-LOW-UNV-DB-F/(XX)FH10-AC(X)-AV1.BWG-ACAS-EMPCK-(XX)					
		FOCAL POINT	ASM1S-BW-8-400LF-935K-11-UNV-SP-J24-EM-6FT0IN					
		LUX ILLUMINAIRE	HLCN 1.0-P-D-400-6-35K-9-UNV-S1-BAFF FIN-B-8-HC-24-SQ-BF-VDO-EB					
		METALUMEN	S1-ACL-35K-6-RA-08-50-1-B-PA18-UNV-OD-VDO-90-FD					
B2EM	400 LUMENS/FOOT, 3500K, LED	AXIS	SCDSZ-400-80-35-FL-8-H8-XX-XX-UNV-DP-1-XX-B-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 10'-0" A.F.F.	34.0W	2-WIDE, 8-FOOT PENDANT MOUNT LINEAR WITH ACCOUSTIC MATERIAL WRAP. PROVIDE INTEGRAL 10W EMERGENCY BATTERY BACK-UP, SMART WIRELESS SYSTEM OCCUPANCY SENSOR, AND DAYLIGHT HARVESTING SENSOR.	1
		CORONET	LS1.STFU-8-35-LOW-UNV-DB-F/(XX)FH10-AC(X)-AV1.BWG-ACAS-EMPCK-(XX)					
		FOCAL POINT	ASM1S-BW-8-400LF-935K-11-UNV-SP-J24-EM-8FT0IN					
		LUX ILLUMINAIRE	HLCN 1.0-P-D-400-8-35K-9-UNV-S1-BAFF FIN-B-8-HC-24-SQ-BF-VDO-EB					
		METALUMEN	S1-ACL-35K-8-RA-08-50-1-B-PA18-UNV-OD-VDO-90-FD					
B3EM	400 LUMENS/FOOT, 3500K, LED	AXIS	SCDSZ-400-80-35-FL-10-H8-XX-XX-UNV-DP-1-XX-B-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 10'-0" A.F.F.	42.5W	2-INCH WIDE, 10-FOOT PENDANT MOUNT LINEAR WITH ACCOUSTIC MATERIAL WRAP. PROVIDE INTEGRAL 10W EMERGENCY BATTERY BACK-UP, SMART WIRELESS SYSTEM OCCUPANCY SENSOR, AND DAYLIGHT HARVESTING SENSOR.	1
		CORONET	LS1.STFU-10-35-LOW-UNV-DB-F/(XX)FH10-AC(X)-AV1.BWG-ACAS-EMPCK-(XX)					
		FOCAL POINT	ASM1S-BW-8-400LF-935K-11-UNV-SP-J24-EM-10FT0IN					
		LUX ILLUMINAIRE	HLCN 1.0-P-D-400-10-35K-9-UNV-S1-BAFF FIN-B-8-HC-24-SQ-BF-VDO-EB					
		METALUMEN	S1-ACL-35K-10-RA-08-50-1-B-PA18-UNV-OD-VDO-90-FD					
B4	354 LUMENS/FOOT, 3500K, LED	AXIS	EX4R-400-80-35-SO-6-W-UNV-DP-1-D-BR-A-P-2-OIP	0-10V	RECESSED IN GRID CEILING	21.6W	4-INCH WIDE, 6-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL SMART SYSTEM PIR SENSOR	
		PINNACLE ARCHITECTURAL LIGHTING	EV3-WET-835-6-IND-FL(F)-U-SCD-E-W					
		FINELITE	HP-4WL-R-D-6'-S-835-F-96-120-SC-FC-10%-VF-C4-FE-SW-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-R-V-WET-FT-375-6-35K-8-UNV-S1-W-VDO					
		-	-					
B4EM	354 LUMENS/FOOT, 3500K, LED	AXIS	EX4R-400-80-35-SO-6-W-UNV-DP-1-D-BR-A, P, 2, OIP	0-10V	RECESSED IN GRID CEILING	21.6W	4-INCH WIDE, 6-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL SMART SYSTEM PIR SENSOR AND EXTERNAL 10W EMERGENCY BATTERY BACK-UP.	2
		PINNACLE ARCHITECTURAL LIGHTING	EV3-WET-835-6-IND-FL(F)-U-SCD-E-1FSG-W					
		FINELITE	HP-4WL-R-D-6'-S-835-F-96-120-SC-FC-10%-VF-C4-FE-SW-GTD-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-R-V-WET-FT-375-6-35K-8-UNV-S1-W-EC-VDO					
		-	-					
B5EM	721 LUMENS/FT DIRECT, 428 LUMENS/FT INDIRECT 3500K, LED	AXIS	TB4DILED-400-721-80-35-SO-SO-S(24')-W-UNV-DP-1-XX-B-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 12'-0" A.F.F.	252.0W	4-INCH WIDE, 24-FOOT DIRECT/INDIRECT PENDANT MOUNT LINEAR. PROVIDE INTEGRAL SMART WIRELESS SYSTEM OCCUPANCY SENSOR, INTEGRAL 18W EMERGENCY BATTERY-UP.	
		NULITE	RP44-B-ST-F-TG-07-05-L35-UNV-D-NLT(X)-(X)-(X)-(X)B10-WH-T1-W-048-24					
		FINELITE	HP-4-P-ID-24'-S-H-835-TG-F-96LG-120-SC-FC-10%-FA50-C1-FE-SW-LGD10W-OBO4-OBD-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-P-DI-LAM-750-LAM-500-24-35K-8-1-UNV-S1-W-15C-102-WF-VDO-EB					
		LITECONTROL	4L-P-ID-STD-24'-08-SOF-_-35K9-I030-D700-D01-1C-UNV-FA1-EF-NXWRM					
B6EM	479 LUMENS/FT, 3500K, LED	AXIS	BBRLED-480-80-35-FL-12-W-UNV-DP-1-DF-B	0-10V	RECESSED IN GYP CEILING	55.2W	4-INCH WIDE, 12-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL 18W EMERGENCY BATTERY BACK-UP.	
		NULITE	RG4-D-ST-F-05-L35-UNV-D--(X)-(X)-B10-WH-6					
		FINELITE	HP-4-R-D-12'-B-835-F-96LG-120-SC-FC-10%-C3-FE-SW-LGD10W-OBO-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-R-FT-LAM-500-12-35K-8-UNV-S1-W-EB					
		LITECONTROL	4L-SS-D-6'-08-SOF-C1-35K9-D500-D01-1C-UNV-EF					
B7	375 LUMENS/FT, 3500K, LED	AXIS	BBRLED-480-80-35-FL-6-W-UNV-DP-1-DF-WC(WC-A-DP-3-BI)	0-10V	RECESSED IN GRID CEILING	27.6W	4-INCH WIDE, 6-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL SMART SYSTEM OCCUPANCY SENSOR AND DAYLIGHT HARVESTING SENSOR.	
		NULITE	RG4-D-ST-F-05-L35-UNV-D-NLT3-WH-6					
		FINELITE	HP-4-R-D-6'-B-835-F-96LG-120-SC-FC-10%-C3-FE-SW-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-R-FT-LAM-500-6-35K-8-UNV-S1-W-VDO					
		LITECONTROL	4L-SS-D-4'-6-SOF-C1-35K9-D040-D01-1C-UNV-NXWRM					
B7EM	375 LUMENS/FT, 3500K, LED	AXIS	BBRLED-480-80-35-FL-6-W-UNV-DP-1-DF-B-WC(WC-A-DP-3-BI)	0-10V	RECESSED IN GRID CEILING	27.6W	4-INCH WIDE, 6-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL SMART SYSTEM OCCUPANCY SENSOR, DAYLIGHT HARVESTING SENSOR, INTEGRAL 10W EMERGENCY BATTERY BACK-UP	
		NULITE	RG4-D-ST-F-05-L35-UNV-D-NLT3-B10-WH-6					
		FINELITE	HP-4-R-D-6'-B-835-F-96LG-120-SC-FC-10%-C3-FE-SW-LGD10W-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-R-FT-LAM-500-6-35K-8-UNV-S1-W-VDO-EB					
		LITECONTROL	4L-SS-D-4'-6-SOF-C1-35K9-D040-D01-1C-UNV-EF-NXWRM					
B8	375 LUMENS/FT, 3500K, LED	AXIS	TB4DLED-480-80-35-SO-6-W-UNV-DP-1-SA(16)-WC(WC-A-DP-3-BI)	0-10V	PENDANT MOUNTED AT 9'-8" A.F.F	27.6W	4-INCH WIDE, 6-FOOT DIRECT RECESSED LINEAR. PROVIDE INTEGRAL SMART SYSTEM OCCUPANCY SENSOR AND DAYLIGHT HARVESTING SENSOR.	
		NULITE	RP44-D-ST-05-L35-UNV-D-NLT3-1-WHSR-W-048-6					
		FINELITE	HP-4-P-D-6'-B-835-F-96LG-120-SC-FC-10%-FA50-FE-SW-NLIGHT AIR/NLIGHT AIR RIO					
		LUX ILLUMINAIRE	EOS 4.0-P-D-LAN-500-6-35K-8-UNV-S1-W-HC-24-WF-VDO					
		LITECONTROL	4L-P-D-6-6-SOF-C1-35K9-D040-D01-1C-UNV-FA1-NXWRM					
C1	1,500 LUMEN, 3500K, LED	PROTFOLIO	LD6C15D010-EU6C10259035-6LBW1LIWPN	0-10V	RECESSED IN GRID CEILING	14.7W	6-INCH RECESSED CAN. PROVIDE INTEGRAL WIRELESS COMMUNICATION MODULE.	
		HE WILLIAMS	6DR-TL-L15/835-AWNR-DIM-UNV-LW-OF-WH-N-F1					
		GOTHAM	EV06-35/15-AR-LD-WD-MVOLT-GZ10-NLTAIR2-SF					
		LIGHTOLIER	6RN / C6L15935WRAU / C6RDLCC / SBA					
		PRESCOLITE	LTR-6RD-H-SL-15L-DM1-NXW-LTR-6D-T-SL-35K-8-XW-SS					
C1EM	1,500 LUMEN, 3500K, LED	PROTFOLIO	LD6C15D010EM14-EU6C10259035-6LBW1LIWPN	0-10V	RECESSED IN GRID CEILING	14.7W	6-INCH RECESSED CAN. PROVIDE INTEGRAL 10W EMERGENCY BATTERY BACK-UP AND INTEGRAL WIRELESS COMMUNICATION MODULE.	
		HE WILLIAMS	6DR-TL-L15/835-AWNR-EM/10W-DIM-UNV-LW-OF-WH-N-F1					
		GOTHAM	EV06-35/15-AR-LD-WD-MVOLT-GZ10-NLTAIR2-EL-SF					
		LIGHTOLIER	6RN / C6L15935WRAU / C6RDLCC-IEM6/SBA					
		PRESCOLITE	LTR-6RD-H-SL-15L-DM1-NXW-EM-LTR-6D-T-SL-35K-8-XW-SS-EM					
D1	1,500 LUMEN, 3500K, LED	LIGHT ART	LA2-ESS-FOUR-48H-GO-XX-835-WL-SSB	0-10V	WALL MOUNTED AT 3'-0" A.F.F	60.0W	46" FULLY SEALED LINEAR WALL SCONCES.	
		-	-					
		ALVA	AU-L60W-35-9-SR4W446H-W-WH-AM					
		PACO	PUCO-4F-25-8-35-MVD					
		SOLERA	SAL-III-64W-2C-3500K-UNV-WM-OCT-OAL-F-DM-WH					
D2	4,000 LUMEN, 3500K, LED	METALUX	4ILED-LD5-5-W-FL-UNV-L835-CD1-U	0-10V	SURFACE MOUNTED	30.5W	4-FOOT LED LOW BAY FIXTURE.	
		HE WILLIAMS	80R-4-L52/835-R1240-(L40)-DIM-120					
		LITHONIA	UFIT-L48-4000LM-SEF-MVOLT-GZ10-35K-80CRI-WH					
		DAYBRITE	LBX40L835-UNV / LBX-HANGER BKT					
		COLUMBIA LIGHTING	MPS-4-40-LW-C-W-ED-U					
D2EM	4,000 LUMEN, 3500K, LED	METALUX	4ILED-LD5-5-W-FL-UNV-L835-EL14W-CD1-U	0-10V	SURFACE MOUNTED	30.5W	4-FOOT LED LOW BAY FIXTURE. PROVIDE INTEGRAL 10W EMERGENCY BATTERY BACK-UP.	
		HE WILLIAMS	80R-4-L52/835-R1240-(L40)-EM/AL14W-DIM-120					
		LITHONIA	UFIT-L48-4000LM-SEF-MVOLT-GZ10-35K-80CRI-WH-PS1055LCP					
		DAYBRITE	LBX40L835-UNV-EMLED / LBX-HANGER BKT					
		COLUMBIA LIGHTING	MPS-4-40-LW-C-W-ED-U-ELL14					
W1EM	476 LUMEN, 4000K, LED	ISOLITE	ODLM-10-EM-BK-MMK	0-10V	MULLION MOUNT AT	5.0W	12-INCH WIDE MULLION MOUNTED EGRESS LIGHT. PROVIDE 10W EMERGENCY BATTERY BACK-UP, EXTERNAL PHOTOCELL	
		LSI INDUSTRIES	LAW2-M-1-05L-0L-840-FA-S-I-UNV-ALBMR1-ALBMR1-BLK-CWBB					
		LUMINAIRE LED	BLD-12IN-MIN10-2DRV-5W-40K-MVOLT-DP-BLK-EMB310-PC-PIR					
		BARRON EXITRONIX	NF5-WB-10L-MWM-FINISH-SEC120					
		ADVANTAGE ENVIRONMENTAL LIGHTING	LDE-12-05L-TDRV-40-M-FP156-BLK-14EBL-PC					
W2EM	1,875 LUMEN, 4000K, LED	MCGRAW EDISON	GKO-PB1E-740-U-T4W-BK-WPS4BK	0-10V	WALL MOUNTED AT 12'-0" A.F.F.	47.0W	EXTERIOR WALL MOUNTED LED WALL PACK WITH DIMMING OPERATION. PROVIDE INTEGRAL 20W BATTERY BACKUP, EXTERNAL PHOTOCELL, BLACK FINISH.	
		HE WILLIAMS	VWPV-L30/740-TFT-BLK-EM/10WC-OCCWS-FSP-311-L2-120/277					
		LITHONIA	WDGE2 LED P4-35K-70CRI-TFTM-MVOLT-SRM-E20WC-PE-PIR					
		GARDCO	101L-16L-400-NW-G2-4-EBPC-120-IMRI3-PCB-BK					
		BEACON	VPW-ST-18L-25-4K7-4F-UNV-BLT-BTSO-12F-EH					
W3EM	476 LUMEN, 4000K, LED	ISOLITE	ODLM-20-EM-BK-MMX	0-10V	MULLION MOUNT AT	10.0W	24-INCH WIDE MULLION MOUNTED EGRESS LIGHT. PROVIDE 10W EMERGENCY BATTERY BACK-UP, EXTERNAL PHOTOCELL	
		LSI INDUSTRIES	LAW2-M-2-05L-0L-840-FA-S-I-UNV-ALBMR1-BLK-CWBB					
		LUMINAIRE LED	BLD-24IN-MIN10-2DRV-10W-40K-MVOLT-DP-BLK-EMB310-PC-PIR					
		BARRON EXITRONIX	NF5-WB-20L-MWM-FINISH-G2-SEC120					
		ADVANTAGE ENVIRONMENTAL LIGHTING	LDE-24-08L-TDRV-40-M-FP156-BLK-14EBL-PC					
X1	LED	ISOLITE	RL-EM-R-U-EH-MTEB	-	UNIVERSAL	5.0W	UNIVERSAL MOUNTING EXIT SIGN, IMPACT RESISTANCE, SCRATCH RESISTANT, AND CORROSION RESISTANT THERMOPLASTIC HOUSING, RED LETTERING ON WHITE BACKGROUND. INTEGRAL EMERGENCY BATTERY BACK-UP.	
		HE WILLIAMS	EXIT-RG-EM-WHT-QS-D					
		LITHONIA	EXRG-EL-M6					
		CHLORIDE	C4XE-R-N-CT-W-2					
		COMPASS	CER					
X2	LED	ISOLITE	RL-EM-R-U-WH-MTEB-WG-16.0LX11.0WX3.0D	-	UNIVERSAL	5.0W	UNIVERSAL MOUNTING EXIT SIGN, IMPACT RESISTANCE, SCRATCH RESISTANT, AND CORROSION RESISTANT THERMOPLASTIC HOUSING, RED LETTERING ON WHITE BACKGROUND. PROVIDE INTEGRAL EMERGENCY BATTERY BACK-UP AND WIREGUARD.	
		HE WILLIAMS	EXIT-RG-EM-WHT-QS-WG-D					
		LITHONIA	EXRG-EL-M6-ELA-WG1					
		CHLORIDE	C4XE-R-N-CT-W-2-WG5					
		COMPASS	CER-WGEL					
E	1000 LUMEN LED	SURE-LITES	SEL50	-	UNIVERSAL	1.0W	WALL MOUNT EMERGENCY LIGHTING UNIT	
		HE WILLIAMS	EMER/LED-WHT-SDT-D					
		LITHONIA	ELM6L-UVOLT-LTP					
		CHLORIDE	CLUNW					
		COMPASS	CU2					

NOTES:
1. PROVIDE NLIGHT AIR RIO/RES7 TO FIXTURE MODELS WITH "SP" IN MODEL NUMBER.
2. LUMINAIRE CORD SHALL BE MC CABLE AND NOT SO CABLE.

Branch Panel: RPD

Location: ELEC 109
Supply From: (E) MDP
Mounting: SURFACE
Enclosure: NEMA1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000 AMPS SYMMETRICAL
Mains Type: MLO
Mains Rating: 400 A

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	RCPTS: CORRIDOR 101 &...	20 A	1	900	1080					1	20 A	RCPTS: CLASSROOM A 102	2
3	VESTIBULE 100 DOOR POWER	20 A	1			500	500			1	20 A	COMPUTER CART CLASSROOM A	4
5	RCPTS: CLASSROOM A 102	20 A	1					540	500	1	20 A	COMPUTER CART CLASSROOM A	6
7	RCPTS: CLASSROOM A 102	20 A	1	900	500					1	20 A	COMPUTER CART CLASSROOM B	8
9	RCPTS: CLASSROOM B 103	20 A	1			900	500			1	20 A	COMPUTER CART CLASSROOM B	10
11	RCPTS: CLASSROOM B 103	20 A	1					1080	540	1	20 A	RCPTS: CLASSROOM B 103	12
13	RCPTS: CLASSROOM C 104	20 A	1	900	500					1	20 A	COMPUTER CART CLASSROOM C	14
15	RCPTS: CLASSROOM C 104	20 A	1			1080	540			1	20 A	RCPTS: CLASSROOM C 104	16
17	COMPUTER CART CLASSROOM C	20 A	1					500	720	1	20 A	EWC CORRIDOR 101	18
19	RECIRCULATING PUMP / DWH-1	20 A	1	360	1176					1	20 A	GYMNASIUM 107 BACKBOARD	20
21	AUTO FLUSH VALVE 105A & 105B	20 A	1			372	1176			1	20 A	GYMNASIUM 107 BACKBOARD	22
23	RCPTS: GYMNASIUM 107	20 A	1					1080	1176	1	20 A	GYMNASIUM 107 BACKBOARD	24
25	RCPTS: GYMNASIUM 107	20 A	1	1080	1176					1	20 A	GYMNASIUM 107 BACKBOARD	26
27	GYMNASIUM 107 SCOREBOARD	20 A	1			500	1040			2	20 A	DF-1	28
29	LTG: GYM STORAGE/ELEC	20 A	1					92	1040				30
31	LTG: GYMNASIUM	20 A	1	1122	500					1	20 A	GYMNASIUM 107 SCOREBOARD	32
33	LTG: GYMNASIUM	20 A	1			1116	1040			2	20 A	DF-2	34
35	LTG: GYMNASIUM	20 A	1					1122	1040				36
37	EUH-1	20 A	3	1598	1440					1	20 A	EWC GYMNASIUM 107	38
39						1598	240			1	20 A	VESTIBULE 106 DOOR POWER	40
41								1598	500	1	20 A	ACCESS CONTROL PANEL	42
43	RTU-1	110 A	3	13434	10915					3	125 A	RTU-2	44
45						13434	10915						46
47								13434	10915				48
49	EUH-2	20 A	2	2400	200					1	20 A	NAC	50
51						2400	362			1	20 A	LTG: RESTROOM/ALCOVE	52
53	LTG: EXTERIOR CANOPY/SITE	20 A	1					602	500	1	20 A	BMS CONTROL PANEL	54
55	MECHANICAL EQUIPMENT...	20 A	1	180	1446					2	20 A	GRINDER PUMP	56
57	EF-1, EF-2	20 A	1			636	1446						58
59	LTG: CLASSROOM 104	20 A	1					813	799	1	20 A	LTG: CORRIDROR/VESTIBULE	60
61	LTG: CLASSROOM 102	20 A	1	813	180					1	20 A	RCPT: GENERATOR CONV	62
63	LTG: CLASSROOM 103	20 A	1			813	500			1	20 A	CORRIDOR DOOR HOLD	64
65	RCPT: EXISTING EXTERIOR...	20 A	1					360	500	1	20 A	CORRIDOR 110 DOOR POWER	66
67	**HEAT TRACE**	**20 A**	**2**	1040	520					**2**	**20 A**	**HEAT TRACE**	68
69						1040	520						70
71	GENERATOR BLOCK HEATER	20 A	1					600	520	**2**	**20 A**	**HEAT TRACE**	72
73	GENERATOR BATTERY...	20 A	1	600	520								74
75	MDF RACK	20 A	1			500	0			1	20 A	SPARE	76
77	RCPT: CORRIDOR & EXTERIOR	20 A	1					1800	0	1	20 A	SPARE	78
79	SPARE	20 A	1	0	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:	45481 VA		43670 VA		42373 VA					
			Total Amps:	381 A		366 A		353 A					

Load Classification	Connected Load	Demand Factor	Estimated...	Panel Totals	
Other	3954 VA	100.00%	3954 VA		
MTR	95533 VA	110.55%	105609 VA	**Total Conn. Load:**	131523 VA
RCPT	20224 VA	74.72%	15112 VA	**Total Est. Demand:**	139440 VA
LITES	7652 VA	125.00%	9565 VA	**Total Conn.:**	365 A
HEAT TRACE	4160 VA	125.00%	5200 VA	**Total Est. Demand:**	387 A

BOLD: GFCI BREAKER

LIGHTING CONTROLS SEQUENCE OF OPERATION:

1. **HOURS OF OPERATION**
   - A. GENERAL NOTE: CONFIRM ALL TIMECLOCK SCHEDULES AND SENSOR TIME DELAYS WITH OWNER PRIOR TO FINAL PROGRAMMING.
     - a. OCCUPIED HOURS: SUN-SAT 8:00 AM - 2:00 PM.
     - b. BUISNESS HOURS: SUN-SAT 7:00 AM - 4:00 PM.
2. **GENERAL REQUIREMENTS:**
   - A. LIGHTING CONTROL INTENTIONS IS TO USE LIGHT FIXTURES WITH INTEGRATED CONTROLS AND ASSOCIATED LOW VOLTAGE SWITCHES, UNLESS NOTED OTHERWISE. DEVIATION FROM THIS SOLUTION SHALL MEET CONTROL INTENTIONS AND COORDINATED WITH ELECTRICAL CONTRACTOR FOR ADDITIONAL WIRING AND INSTALLATION.
   - B. ALL SWITCHED WITH "LVS#" ARE LOW VOLTAGE CONTROL STATIONS. PROVIDE ON/OFF BUTTONS, PRE-PROGRAMMED SCENES, INEGRAL OCCUPANCY SENSING, AND/OR DIMMING CONTROL AS DESCRIBED BELOW PER SPACE.
   - C. COORDINATE COMMISSIONING OF SYSTEM PER LIGHTING, LIGHTING CONTROL, AND COMMISSIONING SPECIFICATIONS WITH OWNER'S AGENT AS REQUIRED PER STATE OF MICHIGAN ENERGY CODE.
   - D. EMERGENCY LIGHTING: ALL EMERGENCY FIXTURES SHALL BE PROGRAMMED TO FUNCTION WITH AREA NORMAL LIGHTS. UPON LOSS OF POWER, EMERGENCY LIGHTING EXCEPT IN THE GYM IS POWERED FROM INTEGRAL EMERGENCY BATTERY TO FIXTURES DESIGNATED AS EMERGENCY. EMERGENCY EGRESS LIGHTING IN GYM IS POWERED FROM EXTERNAL BATTERY INVERTER. UPON LOSS OF POWER, ALL LIGHTS DESIGNATED AS EMERGENCY SHALL TURN ON AT FULLY EMERGENCY BATTERY BACK-UP OUTPUT.
   - E. DAYLIGHT HARVESTING: REFER TO DRAWINGS FOR PRIMARY AND SECONDARY ZONES. ALL LIGHTS IN THESE AREAS SHALL INCLUDE OCCUPANCY AND PHOTOSENSING DEVCES FOR AUTOMATIC CONTROL.
     - a. EACH FIXTURE/SENSOR SHALL BE CALIBRATED INDIVIDUALLY.
     - b. TARGET SET POINT FOR LIGHTING IS 40 FOOTCANDLES (WHEN NO DAYLIGHT IS PRESENT).
     - c. LIGHTS SHALL BE PROGRAMMED FOR CONTINUOUS DIMMING FROM LOW TO HIGH END.
     - d. ONCE LIGHT LEVELS HAVE INCREASED/DECREASED MORE THAN 15%, FIXTURES SHALL RESPOND AND ADJUST TO SET POINT.
     - e. PROGRAM DELAY, 10-MINUTES, TO TRANSITION TO SET POINT TO AVOID CLOUDS AND OTHER TEMPORARY NATURAL LIGHT BLOCKAGE.
     - f. PROGRAM FADE TIME TO SET POINT OVER 5-MINUTES.
3. **EXTERIOR FIXTURES:**
   - A. BUILDING LUMINAIRES SHALL TURN ON 30-MINUTES PRIOR TO SUNSET AND REMAIN ON UNTIL MIDNIGHT. BETWEEN MIDNIGHT AND 6AM, FIXTURES SHALL REMAIN OFF. AT 6AM FIXTURES SHALL TURN ON AT 100% AND REMAIN ON UNTIL 30-MINUTES AFTER SUNRISE.
   - B. BUILDING EGRESS LUMINAIRES BE PROGRAMMED TO TURN ON 30-MINUTES PRIOR TO SUNSET AND STAY ON 30-MINUTES AFTER SUNRISE. UPON LOSS OF POWER, BATTERY SHALL POWER LIGHT FIXTURES.
   - C. FIXTURES ARE CONTROLLED VIA PHOTOCELL AND ROOM CONTROLLER.
4. **CLASSROOMS:**
   - A. LIGHTING TO BE CONTROLLED BY INTEGRAL SMART SENSORS.
   - B. LIGHTING SHALL BE MANUAL ON.
   - C. PROVIDE DAYLIGHT HARVESTING. FIXTURES IN PRIMARY AND SECONDARY DAYLIGHT ZONES SHALL BE CONNECTED TO INTERNAL PHOTOCELL.
   - D. LIGHTING SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN TURN OFF VIA INTERNAL OCCUPANCY SENSOR.
   - E. CONTROLLED RECEPTACLES SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN TURN OFF VIA OCCUPANCY SENSOR.
   - F. **LV1** STATIONS SHALL INCLUDE:
     - a. ALL ON
     - b. DIM UP
     - c. 50%
     - d. DIM DOWN
     - e. ALL OFF
5. **HALLWAY:**
   - A. LIGHTING TO BE CONTROLLED BY INTEGRAL SMART SENSORS.
   - B. PROVIDE TIME OF DAY SCHEDULING.
   - C. LIGHTING SHALL TURN ON AUTOMATICALLY TO 100% AT 7AM.
   - D. PROVIDE DAYLIGHT HARVESTING. FIXTURES IN PRIMARY AND SECONDARY DAYLIGHT ZONES SHALL BE CONNECTED TO INTERNAL PHOTOCELL.
   - E. LIGHTING SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN DIM TO 50% VIA INTERNAL OCCUPANCY SENSOR.
   - F. LIGHTING SHALL REMAIN ON UNTIL 4PM.
   - G. **LV2** STATIONS SHALL INCLUDE:
     - a. ALL ON
     - b. ALL OFF
6. **VESTIBULE:**
   - A. LIGHTING TO BE CONTROLLED BY INTEGRAL SMART SENSORS.
   - B. PROVIDE TIME OF DAY SCHEDULING.
   - C. LIGHTING SHALL TURN ON AUTOMATICALLY TO 100% AT 7AM.
   - D. LIGHITNG SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN DIM TO 50% VIA INTERNAL OCCUPANCY SENSOR.
   - E. LIGHTING SHALL REMAIN ON UNTIL 4PM.
   - F. **LV3** STATIONS SHALL INCLUDE:
     - a. ALL ON
     - b. ALL OFF
7. **TOILET ROOM:**
   - A. LIGHTING SHALL TURN ON AUTOMATICALLY AT 100% VIA INTERNAL OCCUPANCY SENSORS.
   - B. LIGHTING SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN TURN OFF.
   - C. **LV4** STATIONS SHALL INCLUDE:
     - a. ALL ON
     - b. ALL OFF
8. **GYM STORAGE:**
   - A. LIGHTING SHALL TURN ON AUTOMATICALLY AT 100% VIA SWITCH TYPE OCCUPANCY SENSORS.
   - B. LIGHTING SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN TURN OFF.
9. **ELECTRICAL:**
   - A. LIGHTING SHALL BE MANUAL ON/OFF.
   - B. EMERGENCY LIGHTING FIXTURES SHALL BE PROVIDED WITH EMERGENCY BATTERY BACK-UP.
10. **GYMNASIUM:**
    - A. LIGHTING TO BE CONTROLLED BY INTEGRAL SMART SENSORS.
    - B. LIGHTING SHALL BE MANUAL ON.
    - C. EMERGENCY LIGHTING FIXTURES SHALL BE CONNECTED TO INVERTER CIRCUIT BY INTERNAL DIMMING GENERATOR TRANSFER DEVICE.
    - D. PROVIDE DAYLIGHT HARVESTING. FIXTURES IN PRIMARY DAYLIGHT ZONES SHALL BE CONNECTED TO INTERNAL PHOTOCELL.
    - E. LIGHTING SHALL REMAIN ON UNTIL 20 MINUTES AFTER NO ACTIVITY AND THEN TURN OFF VIA EXTERNAL OCCUPANCY SENSOR.
    - F. **LV5** STATIONS SHALL INCLUDE:
      - a. ALL ON
      - b. DIM UP
      - c. 50%
      - d. DIM DOWN
      - e. ALL OFF

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REV	DATE	DESCRIPTION
1	07/23/25	SD OWNER REVIEW
2	09/09/25	DD OWNER REVIEW
3	10/21/25	95% OWNER REVIEW
4	11/07/25	BIDS & PERMITS
5	12/05/25	ADDENDUM #2

WEXFORD MONTESSORI ACADEMY ADDITION SO-1840

5217 Wexford Rd, Lansing, MI 48911

MI ARCHITECTURE
FIRM LICENSE # NLP000605

Engineering & Design

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Colliers Engineering & Design,
Architecture, Landscape Architecture,
Surveying, CT P.C.

PROJECT MANAGER: B. HUYLER	DISCIPLINE LEAD: A. ROBINSON
DESIGNER: A. CARPENTER	REVIEWER: A. ROBINSON
DATE ISSUED: 11/07/25	PROJECT NUMBER: 25009229A

SHEET NAME:
SCHEDULES

DRAWING NUMBER:
E801

NOTE: DO NOT SCALE DRAWING FOR CONSTRUCTION.

12/5/2025 7:17:51 AM