

**ADDENDUM NO. 1
Lansing School District
J.W. Sexton High School
Elevator Replacement**

Date: 10/13/2025
Job Number: 24448.01

OWNER:

Lansing School District
519 W Kalamazoo St
Lansing, MI 48933

ENGINEER:

Matrix Consulting Engineers
544 Cherbourg Dr
Lansing, MI 48906

This Addendum is issued for the purpose of modifying and/or clarifying the original Contract Documents and shall take precedence over them.

All work included herein shall be in accordance with the original drawings and specifications except as specifically noted herein. All incidental items required to provide the following modifications shall be included even though not specifically described.

This addendum is being sent to all bidders receiving plans and specifications. **Receipt of this Addendum shall be noted on the Proposal Form in the appropriate location.**

Drawings

1. **Added all sheets to the Project Documents**
 - a. See G0.1 for Sheet Index.

Specifications

1. **Added all Project Specifications to the Project Documents**
 - a. Updated Specification Table of Contents.

October 8, 2025

**Request for Bids
Lansing School District
Purchasing Department
519 West Kalamazoo
Lansing, MI 48933**

This is not an order

Sealed proposals for the furnishing of items and services listed on the sheets attached to the bid proposal documents that are available on our web-site will be received in the Lansing School District Purchasing Office, 519 W. Kalamazoo St., Lansing, Michigan 48933 until

October 30, 2025, 2:00 PM local time.

At this time and place bids will be opened publicly and read aloud.

One (1) original and Two (2) copies of the bid are to be submitted on the forms furnished by the Lansing School District in a sealed envelope and clearly marked:

Bid SO-1842 Sexton High School Elevator Replacement

BID DOCUMENTS WILL BE POSTED BY October 13, 2025

To obtain a copy of this request for bid please visit our web site at:

www.lansingschools.net

(Click on Quicklinks at the top and click on Vendors (Bid Info), scroll down to Current Requests for Bids or Proposals) or the bid documents are also posted on the State of Michigan's procurement system SIGMA. If you need assistance, please contact the Lansing School District Purchasing Department at 517-755-3030.

No faxed, telephone or e-mailed bids will be accepted. Late submittals will not be considered.

All questions must be in writing and should be directed to Jon Laing, Director of Procurement at:

Projects@lansingschools.net, no later than 2:00 PM on Thursday, October 23, 2025. Addendums will be posted on the Lansing School District's web-site and SIGMA as they are issued.

All bids/proposals must be accompanied by a 5% bid bond and a sworn and notarized statement disclosing any familial relationship with the Board of Education and selected staff. Bids must include the completed statement to be accepted or considered.

All bids shall be submitted in accordance with the attached instructions and shall remain firm for a period of ninety (90) days after the opening of bids.

A bid bond is required with this bid in the amount of 5% of the total bid amount. Certified payrolls are required with each invoice or pay application. A performance, labor and materials bond will be required to cover 100% of the project.

The Lansing School District reserves the right to reject any or all bids in whole or in part and to accept the proposal or portion of the proposal that, in their opinion, best serves the interests of the Lansing School District.

Lansing School District

Jon Laing
Director of Procurement

PRE-BID INFORMATION

There will be a Pre-Bid Meeting held Wednesday, October 22, 2025 at 3:30 PM at Sexton High school, 102 McPherson Ave, Lansing, MI. Attendance is HIGHLY RECOMMENDED.

SPECIFICATION INDEX

<u>DIVISION</u>	<u>SECTION TITLE</u>
	Specification Index Project Identification
<u>DIVISION 00</u>	
Section 001116	Invitation to Bid
Section 002113	Instructions to Bidders
Section 004100	Bid Proposal Form
Section 004373	Proposed Schedule of Values Form
Section 006000	Project Forms
<u>DIVISION 01</u>	
Section 012100	Allowances
Section 013000	Submittals
Section 013516	Alteration Project Procedures
	Lansing School District Standard Contract AIA A201 Agreement
<u>DIVISION 02</u>	
Section 024119	Selective Demolition
<u>DIVISION 03</u>	
Section 033000	Cast-In-Place Concrete
<u>DIVISION 05</u>	
Section 050500	Metal Fabrications
Section 057300	Handrails and Railings
<u>DIVISION 06</u>	
Section 061053	Miscellaneous Rough Carpentry
<u>DIVISION 07</u>	
Section 079600	Joint Sealants
<u>DIVISION 08</u>	
Section 080113	Standard Steel Doors and Frames
Section 087100	Finish Hardware

DIVISION 09

Section 092116	Gypsum Drywall
Section 099100	Painting

DIVISION 14

Section 142400	Hydraulic Elevators
----------------	---------------------

DIVISION 22

Section 220500	Common Work Results for Plumbing
Section 220523	General Duty Valves for Plumbing Piping
Section 220700	Plumbing Insulation
Section 221316	Sanitary Waste and Vent Piping
Section 221319	Sanitary Waste Piping Specialties
Section 221323	Sanitary Waster Interceptors
Section 221429	Sump Pumps

DIVISION 23

Section 230500	Common Work Results for HVAC
Section 230523	General Duty Valves for HVAC Piping
Section 230529	Hangers & Supports for HVAC Piping & Equipment
Section 250553	Identification for HVAC Piping & Equipment
Section 230700	HVAC Insulation
Section 232300	Refrigerant Piping
Section 238126	Split-System Air-Conditioners

DIVISION 26

Section 260010	Basic Electrical Requirements
Section 260500	Common Work Results for Electrical
Section 260519	Low-Voltage Power Conductors and Cables
Section 260526	Grounding & Bonding for Electrical Systems
Section 260529	Hangers and Supports for Electrical Systems
Section 260533	Raceways and Boxes for Electrical Systems
Section 260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
Section 260553	Identification for Electrical Systems
Section 262726	Wiring Devices
Section 262813	Fuses
Section 262816	Enclosed Switches & Circuit Breakers
Section 265119	LED Interior Lighting
Section 265219	Emergency and Exit Lighting

SECTION 02 41 19 SELECTIVE DEMOLITION

1 GENERAL

- A.** This Section requires the selective removal and subsequent off-site disposal of the following:
 - 1.** Portions of Building, walls, utilities, doors, frames, Elevator, and other misc. items as indicated on drawings and as required to accommodate new construction.
- B.** Related work specified elsewhere:
 - 1.** Remodeling construction work and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction.
- C.** Schedule: Submit schedule indicating proposed sequence of operations for selective demolition work to Owner's Representative for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control.
 - 1.** Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
- D.** Occupancy: Owner will occupy portions of the building immediately adjacent to and below areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will impact Owner's normal operations.
- E.** Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
- F.** Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- G.** Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
- H.** Storage or sale of removed items on site will not be permitted.
- I.** Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.
- J.** Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to and from occupied portions of building.
 - 1.** Erect temporary covered passageways as required by authorities having jurisdiction.
 - 2.** Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 - 3.** Protect floors with suitable coverings when necessary.
 - 4.** Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.
 - 5.** Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
 - 6.** Remove protections at completion of work.
- K.** Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.
 - 1.** Damage to concrete, and asphalt paving areas shall be replaced by the Contractor.
 - 2.** Damage to grass areas from this project shall be repaired and hydroseeded. Rut areas shall be filled with clean top soil and hydroseeded at the correct time for seeding.

- L. Traffic:** Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
- M. Utility Services:** Maintain existing utilities indicated to remain. Keep in service and protect against damage during demolition operations.
- N. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.**
 - 1. Maintain fire protection services during selective demolition operations.**
- O. Environmental Controls:** Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.
- P. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.**

2 PRODUCTS

- A. Not used.**

3 EXECUTION

- A. Inspection:** Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of structure surfaces, equipment, or surrounding properties that could be misconstrued as damage resulting from selective demolition work; file with Owner's representative prior to starting work.
- B. Preparation:** Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.
 - 1. Cease operations and notify Owner's representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.**
- C. Cover and protect equipment, and fixtures indicated "to remain" from soilage or damage.**
- D. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building, especially those areas containing computer equipment.**
- E. Provide weatherproof closures for exterior openings resulting from demolition work. Provide Insulated walls when working during the heating season.**
- F. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.**
- G. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.**
- H. Demolition:** Perform selective demolition work in a systematic manner.
 - 1. In areas where there are materials that are hazardous, use the services of a Licensed Abatement Contractor to properly remove and dispose of any and all hazardous materials. Protect adjacent areas of exposure to dusts and fumes that may develop during these material removals.**
 - 2. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.**
 - 3. Locate demolition equipment outside structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.**
 - 4. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.**
- I. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of conflict. Submit report to Owner's representative in written, accurate detail. Pending receipt of directive from Owner's representative, rearrange selective demolition schedule as necessary to continue overall job progress without delay.**

- J.** Salvage Items: When items may have a salvage value carefully remove indicated items, clean, store, and offer to Owner and obtain receipt, or when Owner refuses item, remove from site.
- K.** Disposal of Demolished Materials: Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.
- L.** If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
 - 1.** Burning of removed materials is not permitted on project site.
- M.** Cleanup and Repair: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
- N.** Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 41 19

THIS PAGE
BLANK

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

1 GENERAL:

- A. Codes and Standards: comply with applicable provisions except as otherwise indicated
 1. ACI 301, "Specifications for Structural Concrete Buildings";
 2. ACI 318, "Building Code Requirements for Reinforced Concrete"
 3. ACI-SP-66 (88) "ACI Detailing Manual
 4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practices".
- B. Quality Control: Perform sampling and testing during concrete placement, as follows:
 1. Quality Control: Testing laboratory will perform sampling and testing during concrete placement, which may include the following, as directed by Architect. This testing does not relieve Construction Manager of responsibility of providing concrete in compliance with specifications. Construction Manager may perform additional testing as necessary to ensure quality of concrete.
 2. Sampling: ASTM C 172.
 - a. Slump: ASTM C 143, one of test for each load at point of discharge.
 - b. Air Content: ASTM C 173, one for each set of compressive strength specimens.
 - c. Compressive Strength: ASTM C 39, one set for each 50 cu. yds. or fraction thereof of each class of concrete; one specimen tested at 7 days, one specimen tested at 28 days, and one retained for later testing if required.
 3. Report Test results in writing to Architect, Construction Manager, and concrete producer within 24 hours after tests are made.
- C. Submittals: Submit the following:
 1. Manufacturer's data with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials, and others as requested by Architect.
 - a. Laboratory test or evaluation reports for concrete materials and mix designs.
 - b. Mix Proportions and Design: Proportion mixes complying with mix design procedures specified in ACI 301.
 - c. Submit written report to Architect for each proposed concrete mix at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and are acceptable to Architect.
 - 1) Mix designs may be adjusted when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by Architect.
 - 2) Use air-entering admixture in concrete as indicated.

2 PRODUCTS:

- A. Concrete Materials: As follows:
 1. Portland Cement: ASTM C 150, Type IA.
 - a. Fly Ash: ASTM C 618, Type C or F. Do not to exceed 25 percent of cement content by weight.
 2. Aggregates: ASTM C 33, and MDOT Standard Specifications, Section 8.02, except local aggregates of proven durability may be used when acceptable to Architect.
 3. Water: Drinkable.
 4. Air-Entraining Admixture: ASTM C 260.
 5. All exterior concrete and exposed concrete shall receive air entrainment conforming to MDOT Standard Specifications, Section 8.2403, and shall be measured at 4-6% by volume.
 6. Water-Reducing Admixture: ASTM C 494; type as required to suit project conditions. Use only admixtures that have been tested and accepted in mix designs.
- B. Related Materials: As follows:
 1. Liquid Curing Compound: Comply with ASTM-C-309 Type 2 Class B Vehicle
 2. Type 2 (white pigmented) may be used for exterior concrete.
 3. Products that may be used include

- a. BASF Construction Chemicals – Building Systems; Jure-N-Seal WB
 - b. L&M Construction Chemicals; Dress & Seal WB
 - c. W.R. Meadows, Vocomp-20
- 4. Concrete Additive – Add to mix VaporLock 10/10, dosed at 10 oz/ 100# of cementitious material weight in the mix design, or equal by Xypex.
- C. Form Materials: Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.
 - a. Exposed Concrete Surfaces: Suitable material to suit project conditions.
- D. Reinforcing Materials: As follows:
 - a. Deformed Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.
 - b. Welded Wire Fabric: ASTM A 185.
 - c. Supports: Bolsters, chairs, spacers, and other devices for spacing. Supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications. Use Supports with sand plates or horizontal runners where base material will not support chair legs.
- E. Synthetic Fiber Reinforcement: Fibermesh 150 or equal
 - 1. Propex Concrete Systems Corp., 6025 Lee Highway, Ste 425, PO Box 22788, Chattanooga, Tennessee 37422. Toll Free (800) 621-1273. Phone (423) 892-8080. Fax (423) 892-0157. Website www.fibermesh.com. E-mail fibermesh@propexinc.com
 - 2. Material: 100 percent virgin homopolymer polypropylene multifilament fibers, containing no reprocessed olefin materials.
 - 3. Conformance: ASTM C 1116, Type III.
 - 4. Fire Classifications:
 - a. UL Report File No. R8534-11.
 - b. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
 - 5. Fiber Length: Graded.
 - 6. Alkali Resistance: Alkali proof.
 - 7. Absorption: Nil.
 - 8. Specific Gravity: 0.91.
 - 9. Melt Point: 324 degrees F (162 degrees C).
- F. Expansion Joint Filler;
 - 1. Expansion Joint Filler, polyethylene closed cell backing, size (as recommended by manufacturer) as required for joint width and depth, as manufactured by ChemRex, or approved equal.
- G. Joint Sealant, equal to Sonolastic SL2 multileveling elastomeric polyurethane sealant (three-component system) as manufactured by ChemRex, or approved equal.
- H. Concrete Mix Design, Proportioning and Admixtures:

	"A"	"B"	"C"	"D"
1. Concrete Class	4,000	3,500	3,500	3,000
2. Minimum 28 day, Compressive strength, psi	6 ½	6	6	5 ½
3. Minimum Concrete, Sacks/cu. yd.	5	5 ½	5 ½	6
4. Maximum Water/Cement, Ratio, Gals./sack	4 to 6%	4 to 6%	4 to 6%	none
5. Air Entrainment - %	3"	5"	5"	3"
6. Maximum Slump - inches	X	X		
7. Fiber Mesh Reinforcement (when no WWM)	X			
8. Additive (Vapor Lock/Xypex)				
9. Use locations				
a. Interior Slabs		X		

3 EXECUTION:

- A. Forming and Placing Concrete: As follows:
 - 1. Ready-Mix Concrete: ASTM C 94. Maximum mixing and delivery time is 60 minutes.
 - 2. Add synthetic fiber reinforcement to concrete mixture in accordance with manufacturer's instructions.
 - a. Application Rate: Add synthetic fiber reinforcement at standard application rate of 1.5 pounds per cubic yard (0.90 kg/m3) of concrete.

- b. Mix synthetic fiber reinforcement in concrete mixer in accordance with mixing time and speed of ASTM C 94 to ensure uniform distribution and random orientation of fibers throughout concrete.
3. Formwork:
 - a. Construct so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
 - b. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
 - c. Clean and adjust forms prior to concrete placement. Apply form-release agents or wet forms, as required. Retighten forms during concrete placement if required to eliminate mortar leaks.
4. Reinforcement; Provide multifilament fiber reinforcement in all walks and slabs unless noted otherwise.
5. Reinforcement where shown on details:
 - a. Position, support, and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolsters, spacers, and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - b. Install welded wire fabric in as long lengths as practicable, lapping at least one mesh.
6. Joints: Provide construction, isolation, and control joints as indicated or required. Locate construction joints so as not to impair strength and appearance of structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and random cracking.
7. Installation of Embedded Items: Set and build into work anchorage devices and other embedded items required for other work that is attached to cast-in-place concrete.
8. Concrete Placement:
 - a. Comply with ACI, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.
 - b. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into forms.
 - c. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing., comply with ACI 306 for cold weather concreting and ACI 305 for hot weather concreting.

Concrete Finishes: As follows:

1. Work edges of slabs and joints with a 1/8-inch radius edging tool.
2. Broom finish by drawing a fine hair broom across the concrete surface, perpendicular to the line of traffic. Repeat operation when required to provide a fine line texture acceptable to the Owner or Architect.

Curing:

1. Review floor finish materials for special curing requirements.
2. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours.
3. Continue curing by use of moisture-retaining cover or membrane-forming curing compound.
4. Cure formed surfaces by moist curing until forms are removed.
5. Provide protections as required to prevent damage to exposed concrete surfaces.

**LANSING SCHOOL DISTRICT
SO-1842 SEXTON ELEVATOR REPLACEMENT
ROGER L DONALDSON, AIA P.L.C.
PROJECT #25-06**

THIS PAGE
BLANK

SECTION 05 05 00 METAL FABRICATIONS

1 GENERAL:

- A.** Definitions in ASTM E 985 for railing-related terms apply to this section.
- B.** Structural Performance of Handrails and Railing Systems: Comply with ASTM E 985 based on testing per ASTM E 894 and E 935.
- C.** Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural live loads without exceeding the allowable design working stress of materials involved:
- D.** Submittals: In addition to product data, submit the following:
 - 1. Shop drawings showing details of fabrication, assembly and installation including templates for anchor bolt placement.
 - 2. Samples of materials and finished products as may be requested by Architect.

2 PRODUCTS:

- A.** GENERAL For work exposed to view use materials selected for their smoothness and freedom from surface blemishes. Contractors option to custom shop fabricate or to provide a ladder from an approved manufacturer.
- B.** MATERIALS:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 2. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails.
 - 3. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.
 - 4. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD- C 621.
 - 5. Interior Anchoring Cement: Factory-prepackaged nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site. Use for interior applications only.
 - 6. Fasteners: Provide bolts, nuts, lag bolts, machine screws, wood screws, toggle bolts, masonry anchorage devices, lock washers as required for application indicated and complying with applicable Federal standards. Hot-dip galvanize fasteners for exterior applications to comply with ASTM A 153.
 - 7. Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast-curing, lead-free, universal modified alkyd primer; resistant to normal atmospheric corrosion, compatible with finish paint systems indicated, capable of providing a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.
 - 8. Zinc Chromate Primer: FS TT-P-645.

3 EXECUTION:

- A.** GENERAL: Use materials of size, shape, and thickness shown, or if not show, of required size, grade and thickness to produce strength and durability in finished product.
 - 1. Shop-paint all items not specified to be galvanized after fabrication.
- B.** FABRICATION:
 - 1. Welding;
 - a.** Weld corners and seams continuously to comply with AWS recommendations. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
 - b.** Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

METAL FABRICATIONS

2. Rough Hardware: Furnish custom-fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring woodwork.
 3. Surface Preparation: Comply with SSPC-SP6 "Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.
 - a. Stripe paint edges, corners, crevices, bolts, welds and sharp edges.
 4. Galvanize, unless otherwise indicated.
 - a. Galvanizing ASTM A 123 for fabricated and unfabricated steel products made of uncoated rolled, pressed and forged steel shapes, plates, bars and strip 0.0229 inch and thicker.
 - b. Galvanizing Repair Paint: High zinc dust content paint with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.
 5. Shop Painting: Apply shop primer to surface of metal fabrications except those embedded in concrete or galvanized; comply with SSPC-PA1 and requirements indicated below:
- C. Miscellaneous Fabrications:**
1. Ladders: Fabricate ladders for locations shown, with dimensions, spacings, and anchorages as indicated. Comply with the requirements of ANSI A14.3, unless otherwise indicated.
 - a. Galvanize after fabrication.
 2. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete, as indicated. Drill plates to receive anchor bolts.
 - 1) Galvanize after fabrication.
 3. Loose Steel Lintels: Fabricate from shapes and to sizes indicated.
 - 1) Galvanize after fabrication.
 4. Exterior Handrails: Fabricate from shapes and to sizes indicated.
 - 1) Galvanize after fabrication.
 5. Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework. Fabricate of welded construction in as large units as possible; drill and tap as required to receive hardware and similar items. Include required anchors for building into other work; spaced not more than 24 inches o/c.
 6. Miscellaneous Steel Trim: Fabricate to shapes and sizes as required for profiles shown; continuous welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.
 7. Shelf and Relieving Angles: Fabricate to sizes indicated for attachment to support framing. Provide slotted holes to receive anchor bolts, spaced not more than 6 inches from ends and 24 inches o/c.
 8. Furnish wedge-type concrete inserts complete with fasteners for securing shelf angles to cast-in-place concrete.
 - a. Galvanize shelf angles to be installed on exterior concrete.
- D. Installation:**
1. Perform cutting, drilling and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.
 2. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1-part Portland cement to 3-parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.
 - a. Touch-up shop paint after installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.
 3. Paint exterior handrails after installation.

END OF SECTION 05 05 00

**SECTION 05 73 00
HANDRAILS AND RAILINGS**

Part 1 – General

Section 1.01 SCOPE OF WORK

- A. Architectural glass railings.

Section 1.02 RELATED WORK

- A. Section 08 83 13 - Glass Glazing.

Section 1.03 REFERENCES

A. Aluminum Association (AA):

1. AA ABH-21 Aluminum Brazing Handbook.
2. AA ASD-1 Aluminum Standards and Data.
3. AA DAF-45 Designation System for Aluminum Finishes.
4. AA SAA-46 Standards for Anodized Architectural Aluminum.

B. American Architectural Manufacturers Association (AAMA):

5. AAMA 605.1 Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
6. AAMA 606.1 Voluntary Guide Specifications and Inspection Methods of Integral Color Anodic Finishes for Architectural Aluminum.
7. AAMA 607.1 Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
8. AAMA 608.1 Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

C. American Concrete Institute (ACI):

1. ACI 347 Recommended Practice for Concrete Formwork.

D. American Institute of Steel Construction (AISC):

1. Manual of Steel Construction.

E. American Iron and Steel Institute (AISI):

1. Steel Products Manual; Stainless and Heat Resisting Steel.
2. Code of Standard Practice.

F. American National Standards Institute (ANSI):

1. ANSI A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
2. ANSI A58.1 Minimum Design Loads in Buildings and Other Structures.
3. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities.
4. ANSI A97.1 Safety Performance Specifications and Methods of Test for Safety Glazing Material used in Buildings.
5. ANSI/NAAMM MBG 531 Metal Bar Grating Manual.

G. ASTM International (ASTM):

1. ASTM A 29 Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for.
2. ASTM A 36 Carbon Structural Steel.
3. ASTM A 47 Specification for Ferritic Malleable Iron Castings.
4. ASTM A 48 Specification for Gray Iron Castings.
5. ASTM A 53 Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
6. ASTM A 108 Steel Bars, Carbon, Cold Finished, Standard Quality.
7. ASTM A 123 Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
8. ASTM A 167 Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
9. ASTM A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
10. ASTM A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
11. ASTM A 312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
12. ASTM A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A 512 Specification for Cold-Drawn Butt-weld Carbon Steel Mechanical Tubing.
14. ASTM A 513 Specification for Electric-Resistance-Welded Carbon and Alloy Steel Tubing.
15. ASTM A 554 Welded Stainless Steel Mechanical Tubing
16. ASTM A 570 Specification for Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality.
17. ASTM A 575 Specification for Steel Bars, Carbon, Merchant Quality, M Grades.

**SECTION 05 73 00
HANDRAILS AND RAILINGS**

18. ASTM A 582 Free Machining Stainless and Heat Resisting Steel Bars.
 19. ASTM A 743 Specification for Corrosion-Resistant Iron Chromium, Iron Chromium-Nickel, and Nickel Base Alloy Castings for General Application.
 20. ASTM A1264-1 Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems
 21. ASTM B 43 Specification for Standard Sizes of Seamless Red Brass Pipe.
 22. ASTM B 62 Specification for Composition Bronze or Ounce Metal Castings.
 23. ASTM B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 24. ASTM B 210 Specification for Aluminum and Aluminum Alloy Drawn Seamless Tubes.
 25. ASTM B 211 Aluminum and Aluminum Alloy Bar, Rod and Wire
 26. ASTM B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes
 27. ASTM B 241 Specification for Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube.
 28. ASTM B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 29. ASTM B 455 Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
 30. ASTM B 483 Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
 31. ASTM B 584 Specification for Copper Alloy Sand Castings for General Applications.
 32. ASTM C 595 Specification for Blended Hydraulic Cements.
 33. ASTM C 1036 Standard Specification for Flat Glass.
 34. ASTM C 1048 Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 35. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass.
 36. ASTM D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
 37. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
 38. ASTM E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
 39. ASTM E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 40. ASTM E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings. 41. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings.
 42. ASTM E 1481 Terminology of Railing Systems in Rails for Buildings.
 43. ASTM E 2353 Standard Test Methods for Performance of Glass in Permanent Glass Railing Systems, Guards & Balustrades.
 44. ASTM E 2358 Standard Specification for Performance of Glass in Permanent Glass Railing Systems, Guards & Balustrades.
- H. American Welding Society (AWS):
1. AWS Specifications for Welding Rods and Bare Electrodes.
- I. Americans with Disabilities Act Standards for Accessible Design (ADASAD).
- J. Copper Development Association (CDA):
1. Standards Handbook, Wrought Copper and Copper Alloy Mill Products, Part 2 - Alloy Data.
 2. Standards Handbook, Cast Copper and Copper Alloy Products, Part 7 - Alloy Data.
 3. Copper, Brass and Bronze Design Handbook for Architectural Applications.
- K. General Service Administration (GSA) Federal Specifications (FS):
1. DD-G-1403 Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).
 2. QQ-C-390 Copper Alloy Castings.
 3. QQ-S-766 Stainless Steel, Class 302 or 304.
 4. FS-TT-P-641 Primer Coating, Zinc Dust/Zinc Oxide (for Galvanized Surfaces).
 5. FS-TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type.
 6. FS-TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.
- L. Green Globes System
- M. International Code Council (ICC):
1. International Building Code (IBC).
- N. Iron and Steel Society (ISS):
1. Steel Products Manual
 - a. Sheet Steel.
 - b. Stainless and Heat Resisting Steels.
- O. Association of Architectural Metal Manufacturers (NAAMM):
1. NAAMM/NOMMA Metal Finishes Manual.

2. Pipe Railing Manual.
3. Metal Stair Manual.

Section 1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Submit shop drawings and product data.
 1. Show sections and plans of stairs, dimensions and assembly of components.
 - a. Railings.
 - b. Handrail.
 - c. Brackets.
 - d. Reinforcements.
 - e. Anchors.
 - f. Welded and bolted connections.
 2. Show field connections.
 3. Provide setting diagrams for installation of anchors, location of pockets, weld plates for attachment of rails to structure, and blocking for attachment of wall rail.
 4. Indicate required field measurements.
 5. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.
- C. Submit manufacturer's installation instructions.
- D. Samples:
 1. Submit duplicate samples of railing showing style and finish. One approved sample will be returned to Contractor.
 2. Submit sample(s) of _____
 3. Certificates:
 - a. Furnish manufacturer's certification that materials meet specification requirements.
 - b. Furnish certification and calculations by an engineer registered in the state where the project is located showing that safety requirements are met.

Section 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2-year experience installing similar products.
- C. Regulatory Requirements:
 1. Components and installation shall be in accordance with state and local code authorities.
 2. Components and installation shall comply with current ADASAD or ICC/ANSI A117.1 guidelines.
- D. Certifications:
 1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
 2. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the specified design loads.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 1. Finish areas designated by Architect.
 2. Do not proceed with remaining work until workmanship is approved by Architect.
 3. Refinish mock-up area as required to produce acceptable work.

Section 1.06 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.
- B. Pre-Installation Meeting:
 1. Prior to the beginning of work, conduct a pre-job conference at the job site.
 2. Provide seven calendar days' advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner's representative, architect and subcontractors whose work interfaces with the Work of this section.
 3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
 4. Record the results of the conference and furnish copies to all participants.

**SECTION 05 73 00
HANDRAILS AND RAILINGS**

Section 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- B. Storage On Site:
 - 1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending.
 - 2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
 - 3. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

Section 1.08 PROJECT CONDITION

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

Section 1.09 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
- B. Ensure that field preparation of Work of this section is completed in time to prevent interruption of construction progress.
 - 1. Field measuring for weld plates, sleeves and insert locations.
 - 2. Field measuring.
 - 3. Anchors or inserts for terrazzo or precast concrete.

PART 2 - PRODUCTS Section 2.01 MANUFACTURERS

- A. Acceptable Manufacturer: R & B Wagner, Inc (Wagner Companies) located at: 10600 W. Brown Deer Rd.; Milwaukee, WI 53224; Toll Free Tel: 888-243-6914; Tel: 414-214-0444; Fax: 414-214-0450; Email: [request info \(RFQ@mailwagner.com\)](mailto:request_info(RFQ@mailwagner.com)); Web: www.wagnerarchitectural.com www.shopwagner.com
 - 1. 2" Square x 0.25" wall. grade 316 Satin Stainless Steel "Legato" square post kits with mechanical fittings and attachment for field installation
 - a. Infill: ½ inch thick tempered laminated safety glass panels
 - i. Colour (Clear0 or (Tint)
 - ii. Exposed glass edges (Architect to specify – See section 08 8000)
 - b. Clamps: Round
 - 2. Shop fabricate such that no jobsite welding, grinding or cutting is required.
 - 3. Finish: Brushed satin stainless steel #4 finish
 - 4. Post height: 42 inch – 1067mm
 - 5. Post Configurations:
 - a. End Post Surface Mount
 - b. Mid Post Surface Mount
- B. Wagner Stainless Steel Slotted Top Rail for Glass Railing, 2.50" Diameter With .059" Wall, 18 Foot Lengths Heavy duty bottom flange with snap on decorative flange cover
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

Section 2.02 STRUCTURAL REQUIREMENTS

- A. Railing assembly shall withstand a minimum concentrated load of 200 pounds (91 kg) applied vertically downward or horizontally in any direction, but not simultaneously, at any point at the top of the guard or handrail.
- B. Railing assembly shall withstand a minimum uniform load of 50 pounds per foot (76 kg/meter) applied horizontally or vertically downward, but not simultaneously, on the guard or handrail.
- C. Guard intermediate rails, balusters, panel fillers, cable infill, or posts shall be designed for a uniform load of not less than 50 pounds per square foot (248 kg/sq. meter) applied horizontally over the gross area of the guard of which they are part. Reactions due to this loading need not be added to the loading specified for the main supporting members of the guard.

Section 2.03 MATERIALS AND FINISHES

- A. Stainless Steel:
 - 1. Type 316.
 - 2. Pipe and Tubing: ASTM A 312.
- B. Steel:
 - 1. Pipe: ASTM A 53.

**SECTION 05 73 00
HANDRAILS AND RAILINGS**

2. Tubing: meeting ASTM A 500.
3. Tubing: meeting ASTM A 501.
4. Tubing: meeting ASTM A 512.
5. Bars and Shapes: meeting ASTM A 36.

D. Glass:

1. Laminated, fully tempered, ASTM C 1172, with PVB interlayer.
2. Tint: None.

Section 2.04 ARCHITECTURAL GLASS RAILING SYSTEM

- A. Railing system shall be surface mounted.
- B. Rails: Fabricate rails from stainless steel Wagner No. 316 Stainless
- C. Posts: Fabricate posts from 2 inch outside diameter by 2 inch wall stainless steel tubing.
- D. Infill:
 1. Glass: 1/2 inch (13 mm) tempered laminated glass mounted to posts with panel clips

Section 2.05 FASTENERS

- A. Mechanical fasteners used in the assembly of stainless steel railings shall be manufactured from stainless steel.
- B. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator.

Section 2.06 HANDRAIL BRACKETS

- A. Material: Stainless steel.

Section 2.07 FABRICATION

- B. Form rail-to-end post connections and all changes in rail direction by miter elbows.
- C. Cut material square and remove burrs from all exposed edges, with no chamfer.
- D. Make exposed joints butt tight and flush.
- E. Close exposed ends by use of appropriate end cap.
- F. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
- G. Verify dimensions on site prior to shop fabrication.

PART 3 EXECUTION Section 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

Section 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Supply items to be cast in concrete, embedded in masonry and placed in partitions.

Section 3.04 INSTALLATION

- A. Install in accordance with shop drawings and manufacturer's instructions at locations indicated on the drawings.
- B. Erect work square and level, horizontal or parallel to rake of steps or ramp, rigid, and free from distortion or defects detrimental to appearance or performance.
- C. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

Section 3.05 CLEANING

- A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
- B. Do not use acid solution, steel wool or other harsh abrasives.
- C. If stain remains after washing, remove finish and restore in accordance with NAAMM/NOMMA Metal Finishes Manual.
- D. Finish shall not be removed from anodized aluminum.

Section 3.06 REPAIR OF DEFECTIVE WORK

- A. Remove stained or otherwise defective work and replace with material that meets specification requirements.
- B. Repair damaged finish as directed by Architect.
- C. Replace defective or damaged components as directed by Architect.

Section 3.07 PROTECTION

- A. Protect installed products until completion of project.

SECTION 06 10 53 MISCELLANEOUS ROUGH CARPENTRY

1 GENERAL

1.1 GENERAL

- A. Special Note: Refer to other parts of Document Set for complete Contract requirements. Include all work reasonably inferable from Contract Documents. A capable foreman shall be on-site whenever work is in progress.
- B. Summary: This section specifies Miscellaneous Rough Carpentry, nailers, blocking, and similar applications.
 - 1. Use preservative-treated work and plywood:
 - a. In all locations connection with roofing, flashing and exterior sheet metal.
 - b. In all locations connection with all concrete and masonry materials.
- C. Coordinate dimensions with roof insulation thickness.
- D. Related Work Specified Elsewhere:
 - 1. General project requirements governing work performance and administrative procedures such as submittals and substitutions: Division 1.
- E. Carpentry Standards: Carpentry work will be governed by the recommendations of the National Forest Products Association published in "Manual for House Framing", "Recommended Nailing Schedule", "National Design Specifications for Wood Construction", and related publications.
- F. Delivery and Storage: Deep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

2 PRODUCTS

2.1 MISCELLANEOUS LUMBER AND PLYWOOD

- A. General: Provide lumber and plywood for support or attachment of other construction. Build-up nailers and blocking to necessary shapes and dimensions using least number of pieces feasible.
- B. Lumber Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB or WWPA rules or "No. 2 Boards" per SPIB rules.
- C. Plywood Grade: APA C-D PLUGGED EXTERIOR, except as otherwise indicated.
- D. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- E. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WCLIB - West Coast Lumber Inspection Bureau.
 - 3. WWPA - Western Wood Products Association.
- F. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- G. Plywood Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions,

with APA PRP-108. Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

2.2 FASTENERS

- A.** General: Provide fastening indicated or necessary to meet specified requirements.
 - 1.** Preservation-treated wood: Provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
 - 2.** Nails, Wire, and Brads: FS FF-N-105.
 - 3.** Power Driven Fasteners: National Evaluation Report NER-272.
 - 4.** Wood Screws: ANSI B18.6.1.
 - 5.** Lag Bolts: ANSI B18.2.1.
 - 6.** Bolts: Steel bolts complying with ASTM A 307, Grade; with ASTM A 563 hex nuts and flat washers.

2.3 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A.** Comply with applicable requirements of AWP Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark.
- B.** Pressure-treat above-ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a minimum moisture content, respectively, of 19 percent and 15 percents.
- C.** Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
- D.** Coat cut surfaces to comply with AWP M4.

3 EXECUTION

- A.** Discard units of material with defects that impair quality of Rough Carpentry construction and that are too small to use in fabricating Rough Carpentry with minimum joints or optimum joint arrangement.
- B.** Set Rough Carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C.** Fit Rough Carpentry to other construction; scribe and cope as required for accurate fit. Correlate locations to allow attachment of other construction at intended locations.
- D.** Securely attach Rough Carpentry work to substrate by anchoring and fastening.
- E.** Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.
- F.** Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- G.** Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- H.** Wood in connection with hot-rolled steel framing sections shall be secured to steel with 3/8" bolts, one near each end, and uniformly spaced (30" maximum), with necessary nuts and washers. Wood members over 6" in width shall be secured with two rows of bolts, staggered.
 - 1.** Neither bolt nor nut shall project beyond face of wood, except at locations as (as approved) where there is no possibility of interference with subsequent materials or procedures. Drill holes in steel and wood to receive bolts.
- I.** Install furring plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work. Firestop furred spaces to meet code requirements.

END OF SECTION 06 10 53

SECTION 07 96 00 JOINT SEALANTS

1 GENERAL

1.1 GENERAL

- A. Refer to other parts of Document Set for complete Contract requirements. Include all work reasonably inferable from Contract Documents. A capable foreman shall be on-site whenever work is in progress.

1.2 SUMMARY

- A. This Section requires joint sealants at all occurrences of the following joints:
1. Joints in exterior walls and vertical surfaces using sealant designation UR-1 or UR-3, including but not limited to:
 - a. Control and expansion joints in unit masonry.
 - b. Perimeter joints between masonry and metal frames.
 - c. Control, expansion, and perimeter joints of ceiling and overhead surfaces.
 - d. Control, expansion, and metal frame perimeter joints at exposed interior surfaces of exterior masonry and concrete.
 - e. Related joints in non-traffic horizontal surfaces.
 - f. Other joints as indicated.
 2. Joints in interior traffic surfaces as indicated below, using sealant designation UR-1 or UR-3 (Use T):
 - a. Joints in exposed cast-in-place concrete slabs.
 - b. Other joints as indicated.
- B. Include joint fillers and preparation necessary for proper installation.
- C. Refer elsewhere for the following joint sealing and related work:
1. General project requirements governing work performance and administrative procedures such as submittals and substitutions: Division 1.
 2. Roofing and related flashing: Division 7.
- D. Definitions:
1. "Joint Sealer" is synonymous for either Sealant or Caulk.
 2. "Caulk"; is used for interior joints allowing for differentially movement of adjoining materials.
 3. "Sealant"; is used for sealing exterior joints exposed to the weather and shall seal against moisture penetration.
- E. System Performances: Provide joints sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals that are compatible with and nonstaining to abutting materials.

1.3 SUBMITTALS

- A. Product data from manufacturers for each joint sealer product required, including instructions for joint preparation priming and sealer application. Mark to indicate compliance with requirements.
- B. Color Samples of Elastomeric Sealants: Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, address, names of Architect/Engineers and Owners, plus other information specified.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of the Project.
- B. Single Source Responsibility for Joint Sealer Materials: obtain joint sealer materials from a single manufacturer for each sealant type required.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation color, expiration period for use, pot life, curing time, and mixing instructions of multi-component materials.
- B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F (4.4 deg C).
 - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experiences.
- B. Colors: Provide color of exposed joint sealers indicated or, of not otherwise indicated, as selected by Architect/Engineer from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of indicated base polymer which complies with ASTM C 920 requirements, including those referenced for Type, Grade, and Class. Select products with the classifications appropriate to joint substrates:
 - 1. Use T: Traffic surfaces
 - 2. Use NT: Non-traffic surfaces
 - 3. Use M: Masonry
 - 4. Use G: Glass
 - 5. Use O: Other

2.3 SEALANT DESIGNATION UR-1

- A. Multi-Part Nonsag Urethane Sealant: Type M (Multi-art); Grade NS (Non-Sag); Class 25; uses as applicable to joints substrates. Subject to compliance with requirements, provide one of the following:
- B.

Manufacturer	Product	Use Classifications
1. Mameco	Vulkem 227	T NT M - A O
2. Pecora	Dynatred	T NT M G A O
3. Sonneborn/Rexord	Sonolastic NP2	T NT M G A O
4. Tremco	Dymeric	- NT M G A O

2.4 SEALANT DESIGNATION UR-3

- A. One-Part Nonsag Urethane Sealant: Type S (Single Part); Grade NS (Non-Sag); Class 25; uses as applicable to joint substrates indicated. Subject to compliance with requirements, provide one of the following:
- B.

Manufacturer	Product	Use Classifications
1. Mameco	Vulkem 921	- NT M - A O
2. Mameco	Vulkem 116	T NT M - A O
3. Pecora	Dynatrol I	- NT M G A O
4. Sonneborn/Rexnord	Sololastic NP 1	T NT M G A O
5. Tremco	Dymonic	- NT M - A O
6. PRC	Permapol RC-1	- NT M - A O
7. Sika Corp.	Sikaflex-1a or 15LM	T NT M G A O
8. Schnee-Morehead	S-M 7100 Permathane	- NT M - A O

2.5 SEALANT DESIGNATION ACR

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion latex sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 5 percent. Subject to compliance with requirements, provide one of the following:

1.	Manufacturer	Product
a.	Bostik	Chem-Calk 600
b.	Pecora	AC-20
c.	Sonneborn/Rexnord	Sonolac
d.	Tremco	Tremco Acrylic Latex 834

2.6 SEALANT DESIGNATION SE

- A. Silicone Emulsion Sealant: Manufacturer's standard one part, nonsag, mildew-resistant, silicone-emulsion latex sealant complying with ASTM C 834 and ASTM C 920, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 12-1/2 percent. Product: Dow Corning - Performance Plus Silicone Sealant.

2.7 BACKING AND MISCELLANEOUS MATERIALS

- A. General: Provide materials which are nonstaining; are comparable with joint substrates, sealants, and each other; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- 1) Either open-cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- D. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.
- E. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- F. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine joints to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.
- B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers, oil, grease; waterproofing; water repellants; water; surface dirt; and frost.
 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- C. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- D. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINTS SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790.
- D. Install joint fillers to provide support of sealants during application and to produce the cross-sectional shapes and depths of installed sealants for optimum sealant movement capability. Do not leave gaps between ends of joint fillers. Do not stretch, twist, puncture, or tear joint fillers. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.
 1. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
- E. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses, and providing uniform, cross-sectional shapes and depths for optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Using masking tape to protect adjacent surfaces of recessed tooled joints. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated. Provide flush joint configuration per Figure 6B. Provide recessed joint configuration per Figure 6C of recess depth and at locations indicated.
- G. Clean off excess sealants or sealant smears as work progresses by non-damaging methods and cleaning materials.
- H. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at end of construction. If, despite such protection, damage or deterioration occurs, cut out and remove damaged deteriorated joint sealers immediately and reseal joints with new materials to product joint sealers installations with repaired areas indistinguishable from original work.

END OF SECTION 07 96 00

SECTION 08 01 13 STANDARD STEEL DOORS AND FRAMES

1 GENERAL

- A. Submittals: With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.
- B. Standards: In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI-100.

2 PRODUCTS

- A. Manufacturer: One of the following:
 - 1. Ceco Corp.
 - 2. Pioneer Industries.
 - 3. Republic Builders Products.
 - 4. Steelcraft Manufacturing Co.
- B. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- C. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- D. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.
- E. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.
- F. Shop Applied Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1.
- G. Fire-Rated Assemblies: Provide units that display appropriate UL or FM labels for fire rating indicated.
 - 1. Provide units that comply with UBC (1997) Standard 7-2, including:
 - a. Temperature Rise Rating: Provide labeled doors for stairwell enclosures, which indicate "Temperature rise 30 minutes - 450 deg. F maximum," or better rating.
 - b. Provide Units with "S" rating indicating that unit is approved as a smoke and draft control assembly in compliance with UBC (1997) Standard 7-2 .
 - c. Provide Units complying with Positive Pressure Testing.
- H. Fabrication: Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.
- I. Prepare steel doors and frames to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware."
- J. Reinforce units to receive surface-applied finish hardware to be field applied.
 - 1. Locate finish hardware as indicated or, if not indicated, per DHI "Recommended Locations for Builder's Hardware."
- K. Doors: SDI grades and models specified below or as indicated on drawings or schedules:
 - 1. Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, Model 2, minimum 18-gage cold-rolled steel faces.
 - 2. Interior Doors with Acoustical Seals, provide with polystyrene foam to improve environmental efficiencies.
 - 3. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 2, minimum 16-gage galvanized steel faces in compliance with SDI 112.
 - 4. Provide louvers and vision lights where indicated on the Drawings in accordance with ANSI/SDI A250.8.
- L. Frames: Comply with ANSI/SDI-100, of the types and styles indicated, for materials quality, metal gages, and construction details.
 - 1. Provide standard hollow metal frames for doors, borrowed lights, and other openings as indicated.
 - 2. Fabricate frames with mitered and welded corners.

SECTION 08 01 13

STANDARD STEEL DOORS AND FRAMES

3. Prepare frames to receive 3 silencers on strike jambs of single-door frames and on heads of double-door frames.
4. Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, or masonry openings.
5. Protect inside faces of frames in concrete or masonry wall, using high-build fibered asphalt emulsion coating.
6. Form exterior frames from 16-gage galvanized steel.
7. Provide glazing stops and beads where glazed lights are indicated.

3 EXECUTION:

- A. Installation: Install hollow-metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with clearances specified in ANSI/SDI-100.
- B. Install frames in accordance with SDI 105.
- C. Frames with Acoustical Seals, fill frame voids with expandable spray foam, "Great Stuff" or similar
- D. Install fire-rated units in accordance with NFPA Std. No. 80.
- E. Finish hardware is specified in another Division 8 section.

END OF SECTION 08 01 13

SECTION 08 71 00 FINISH HARDWARE

1 GENERAL

1.1 Hardware Requirements:

- A. Number Designations: Numbers indicating hardware items are ANSI standard number designations.
- B. Acceptable Manufacturers/Products: Acceptable manufacturers for various types of products are listed below. An asterisk (*) following a manufacturer's name designates manufacturer whose products are indicated in Finish Hardware Schedule. Such products are listed in the schedule by specific reference to manufacturers catalog numbers. Except as otherwise indicated, products of equivalent quality, design and function by other listed manufacturers may be used, subject to approval of Architect.
- C. Submit final hardware schedule organized by "hardware sets", to indicate specifically the product to be furnished for each item required on each door.
- D. Furnish templates to each fabricator of doors and frames, as required for preparation to receive hardware.
- E. Comply with applicable building codes at the project site, including but not limited to the following:
 - 1. Comply with Part 4- State of Michigan Building Code Rules, Barrier Free Design Rules, MBC 2021 and ICC/ANSI A117.1-2017 as adopted April 6, 2025.
 - 2. ADAAG, Americans with Disabilities Act Accessibility Guidelines.
 - 3. The Americans with Disabilities Act of 1992, updated 2010.
- F. Submit samples of hardware items, showing each required finish from each manufacturer (for acceptance of color and texture only).
- G. Finish and base material designations are indicated in accordance with ANSI A156.18 or the nearest traditional U.S. commercial finish.
- H. Where base material and quality of finish are not otherwise indicated, provide at least the commercially recognized quality specified in ANSI A156 series standards applicable to each particular type of hardware.

2 PRODUCTS

2.1 Finishes: Provide all exposed hardware in US26D (BHMA 626) finish, Satin Chrome.

2.2 Hinges: (Interior)

- A. Mfrs. of Butts: Hager*, McKinney, Stanley.
 - 1. Hager **Series BB 1191**
- B. Provide full-mortise type hinges on each door, except as otherwise indicated, and except as otherwise needed for proper support and operation of doors. Provide stainless steel pins, except steel pins with steel hinges; non-removable for exterior and public interior exposure, non-rising for non-security exposure, flat button with matching plugs.

2.3 Locks, Latches and Bolts:

- A. Mfrs. of Lock/Latch Sets: Schlage.
 - 1. Schlage Cylinder ND Series, Rhodes (RHO) USD26D Satin chrome Lever, Eschuteon, trim and accessories."
- B. Cylinders:
 - 1. Provide cylinder cores will be provided to Lansing Public School District, Physical Plant Department.
 - 2. All lockable hardware to handle Best Cormax 1C-7 pin core.
 - 3. Lansing Public Schools will key cylinders to existing. Coordinate with Lansing Public School District, Physical Plant Department. Provide 4 key blanks with each lock.
- C. Mfrs. of Door Bolts: Builders Brass Works, Ives*, Sargent, Stanley.
- D. Strikes: Wrought box strikes, with extended lip for latch bolts, except open strike plates may be used in wood frames. Provide dust-proof strikes for foot bolts.

2.4 Door Control Devices:

- A. Mfrs. of Overhead Closers: LCN 4110 & 4116 were required, Smoothee, parallel arms, Metal Cover.
 - 1. Provide parallel-arm closers as indicated, provide units one size larger than recommended for standard-arm units.
 - 2. Size and mount units indicated or, if not indicated, to comply with mfr.'s recommendations for the exposure

condition. Reinforce the substrate as recommended.

- B.** Mfrs. of Holders, Stops, Bumpers: Builders Brass Works, Glynn-Johnson, Ives*, Stanley.
 - 1. Wall Ives **407½**
 - 2. Provide grey rubber exposed resilient parts.
- C.** Finish exposed metal to match hardware, except finish floor plates to match thresholds, quarry tile or similar floor finish.
- D.** Provide recessed plates, wherever possible, to receive insert of resilient, or tile floor finish.
- E.** Silencers: Provide silencers in metal door frames, unless not permitted for fire rating, or unless bumper-type weatherstripping is provided; 3 per single-door frame, 4 per double-door frame.

2.5 Miscellaneous Door Hardware:

- A.** Mfrs. of Miscellaneous Hardware: Provide plates, trim, letter box, viewers, knockers, bells, and similar units as indicated, produced by Builders Brass Works, Ives.
- B.** Fabricate plates and edge trim units 1/16" to 1/2" smaller than actual door dimension. Install with self-tapping screws.
- C.** Provide .050" thick (18 ga.) stainless steel with beveled edges and No. 4 polish for kick plates, armor plates, and edge protection stripping (regardless of finish or other hardware).

3 EXECUTION:

- A.** Hardware Mounting Heights: Door and Hardware Institute "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames", except as otherwise indicated.
- B.** Hardware Mounting Heights: Door and Hardware Institute "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames", except as otherwise indicated.
- C.** Install each hardware item to comply with manufacturer's instructions and recommendations.
- D.** Hardware Adjustment: Return to project one month after Owner's occupancy, and adjust hardware for proper operation and function. Instruct Owner's personnel in proper maintenance and adjustment.

END OF SECTION 08 71 00

SECTION 09 21 16 GYPSUM DRYWALL

1 GENERAL

- A. Not Used

2 PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide gypsum board and related products by one of the following:
1. Georgia-Pacific Corp.
 2. Gold Bond Building Products Div., National Gypsum Co.
 3. United States Gypsum Co.
- B. Steel Framing for Walls and Partitions: Comply with ASTM C 754 and the following:
- C. Steel Studs and Runners: ASTM C 645, 0.0179 inch base metal thickness unless otherwise indicated.
- D. Gypsum Board: Provide gypsum board of types indicated in maximum lengths available to minimize end joints:
1. Exposed Gypsum Board: ASTM C 36, thickness as indicated.
 - a. Type: Type X for all fire rated locations.
 - b. Edges: Tapered and featured for prefilling.
- E. Trim Accessories: ASTM C 840: mfr's standard trim accessories, including cornerbead and edge trim of beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated.
1. Provide corner bead formed from zinc alloy.
 - a. Provide zinc-alloy cornerbead and edge trim for exterior gypsum board.
 - b. Provide one-piece control joints with 1/4 inch wide by 7/16 inch deep vee-shaped slot, covered with removable tape, of roll- formed zinc or extruded vinyl as recommended by gypsum board mfr.
- F. Gypsum Board Joint Treatment Materials: ASTM C 475 and ASTM C 840, and as follows:
1. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
 - a. Use open-weave glass fiber tape where recommended by gypsum board mfr with use of setting-type joint compound.
 2. Setting-Type Joint Compound: Factory-prepackaged, job-mixed chemical-hardening powder products formulated for uses indicated.
 - a. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements:
 - b. Ready-Mix Formulation: Factory-premixed.
 - c. Job-Mixed Formulation: Powder product, mixed with water at Project Site.
 - d. Taping compound formulated for embedding tape and first coat over fasteners and flanges of corner beads and edge trim.
 - e. Topping compound formulated for fill (2nd) and finish (3rd) coats.
 - f. All-purpose compound formulated for use as both taping and topping compound.
- G. Miscellaneous Materials: As follows, recommended by gypsum board mfr:
1. Gypsum Board Screws: ASTM C 1002.

3 EXECUTION:

- A. Install steel framing to comply with ASTM C 754 and ASTM C 840.
- B. Do not bridge building expansion joints with support systems, frame both sides of joints with furring and other supports as indicated.
1. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips other anchorage devices or fasteners as indicated.
 2. Install steel studs with bottom and top runner tracks anchored to substrates. Isolate system from building structure to prevent transfer of loading and deflections into metal support system, both vertically and horizontally.
 3. Frame door and other openings with studs and runners and gage, number and arrangement to comply with mfr's recommendations for size of opening, weight of doors and height and stud size, unless otherwise indicated.
 4. Erect thermal insulation and furring members to comply with mfr's directions.
 5. Install supplementary framing, runners, furring, blocking and bracing at openings and terminations in gypsum

drywall and where required for support of other work which cannot be adequately supported on gypsum board alone.

C. Install and finish gypsum board to comply with ASTM C 840 and as follows:

1. Form "Floating" construction for gypsum boards at internal corners, except where special isolation or edge trim is indicated.
2. Isolate drywall construction from abutting structural and masonry work; provide edge trim and acoustical sealant as recommended by mfr.
3. Screw gypsum board to metal supports.
4. Screw both layers to supports where double-layer work is indicated or otherwise required.
5. Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.
6. Unless otherwise specified in the individual designs, all gypsum board systems shall be finished to Level 4.
 - a. All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes. GA-214-10c.
7. Drywall Finishing: Apply joint tape and joint compound at joints between gypsum boards. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects.
 - a. Install compound in 3 coats (plus prefill of cracks where recommended by mfr); sand between coats and after last coat.
 - 1) Embedding and First Coat: Ready-mix drying type all-purpose or taping compound.
 - 2) Fill (Second) Coat: Ready-mix drying type all-purpose or topping compound.
 - 3) Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

END OF SECTION 09 21 16

SECTION 09 91 00 PAINTING

1 GENERAL

1.1 GENERAL

- A. Refer to other parts of Document Set for complete Contract requirements. Include all work reasonably inferable from Contract Documents. A capable foreman shall be on-site whenever work is in progress.

1.2 SUMMARY

- A. This section requires painting work for all interior and exterior exposed items and surfaces:
1. Those installed under the work of the Contract, except those specifically excluded. See following heading, "Scope Provisions".
 2. Those areas previously painted, and disturbed under the work of the Contract, including surfaces that become exposed as part of the work.
 3. Those that are noted or specified to be painted.
- B. Painting work includes surface preparation, priming of unprimed surfaces, touch-up of shop primers, and application of paint materials. (See "paint" under "Definitions".)
1. Refer to the schedule in Section 2.0.
- C. Related Work Specified Elsewhere:
1. General project requirements governing work performance and administrative procedures such as submittals and substitutions: Division 1.
 2. Specified Field Touch-up: The following items are specified to receive touch-up of shop-applied primer as part of installation; do not paint over unrepaired prime coats of these or other items:

1.3 SCOPE PROVISIONS

- A. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect/Engineer will select from standard colors or finishes available.
- C. Excluded Items:
1. Do not paint the following items, materials and surfaces:
 - a. Paving and other exterior ground surfaces.
 - b. Plant materials.
 - c. Brick masonry.
 - d. Galvanized metal deck that is not shop primed.
 - e. Stainless steel.
 - f. Anodized aluminum.
 - g. Chrome.
 - h. Fluorocarbon coating.
 - i. Plastic laminate; cabinet hardware.
 - j. Roofing.
 - k. Sheet metal flashing not visible from ground level.
 - l. Unprimed door hardware.
 - m. Aluminum door thresholds.
 - n. Aluminum window framing; glass; glazing materials; mirrors.
 - o. Transparent plastic.
 - p. Floor coverings; wall base.
 - q. Ceramic tile floorings.
 - r. Vinyl, fabric, or ceramic wall surfaces.
 - s. Acoustic treatments.
 - t. Spray-texture ceilings
 - u. Signage.
 - v. Wire mesh partitions.
 - w. Fire extinguishers, cabinets.
 - x. Toilet accessories.
 - y. Window treatment.
 - z. Furniture
 - aa. Finished mechanical and electrical operating equipment units.
 - bb. Light fixtures.
 - cc. Sprinkler heads.

- dd. Plumbing fixtures.
- 2. Concealed surfaces such as those in the following generally inaccessible areas:
 - a. Spaces above suspended ceilings and soffits.
 - b. Pipe spaces.
 - c. Duct shafts.
- 3. Operating parts and moving parts of operating equipment and other items for which painting would be obviously detrimental, such as the following:
 - a. Electrical contact surfaces.
 - b. Valve and damper operators.
 - c. Linkages.
 - d. Sensing devices.
 - e. Motor and fan shafts.
 - f. Filters.
- 4. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, nomenclature plates, or piping identification.

1.4 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- B. "DFT" indicates "Dry Film Thickness".

1.5 DESIGN REQUIREMENTS

- A. Number of Colors: For each finish paint product employed, allow for the Architect/Engineer's selection of up to five colors, distributed in any proportion of the total for that product, excluding colors specifically required for mechanical or electrical components.
- B. Color Layout Pattern: Except as otherwise indicated, no highly unusual graphic designs will be required. Color variations and accents as may be reasonably expected based on wall and ceiling surface breaks or construction will be determined and conveyed by the Architect/Engineer after Contract Award.
- C. Color Selection: Verify colors and sheens through submittals.

1.6 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
 - 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Color Samples: Request directions regarding colors and sheens. Provide samples of each color to be applied, with texture to simulate actual conditions. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

1.7 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify the Architect/Engineer of problems anticipated using the materials specified.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color and texture are obtained; simulate finished lighting conditions for review of in-place work. Final acceptance of colors will be from job-applied samples.
- D. Material Quality: Provide the manufacturer's highest quality professional or trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary names used to designate paint colors or materials on schedules are not intended to imply that products named are required or to exclude equal products of other manufacturers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title or material.
 - 2. Product description (generic classification or binder type).
 - 3. Federal Specification number, if applicable.
 - 4. Manufacturer's stock number and date of manufacturer.
 - 5. Contents by volume, for pigment and vehicle constituents.
 - 6. Thinning instructions.

7. Application instructions.
8. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing and application.

1.9 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying period.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 1. Paint Materials Manufacturers:
 - a. The Sherwin-Williams Company (S-W).
 - b. O'Leary Paint (O'Leary)
 - c. The Glidden Company (Glidden).
 - d. ITT

2.2 INTERIOR FINISH PAINT MATERIAL:

- A. Existing Painted Gypsum Drywall
 1. Satin/Egg Shell Finish
 - a. 1st Coat: S-W PrepRite ProBlock Latex, B51 Series
 - b. 2nd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
 - c. 3rd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
- B. New Gypsum Drywall
 1. Satin/Egg Shell Finish
 - a. 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28 Series
 - b. 2nd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
 - c. 3rd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
- C. Corridor Wall with skim coat where vinyl wallcoverings were removed
 1. Satin/Egg Shell Finish
 - a. 1st Coat: S-W Pro Block Interior Oil Primer, B79 Series
 - b. 2nd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
 - c. 3rd Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
- D. Existing Plaster Ceilings with patched areas
 1. Flat Finish
 - a. 1st Coat: S-W Loxon Concrete and Masonry Primer, LX02 Series
 - b. 2nd Coat: S-W ProMar 200 Zero VOC Interior Latex Flat, B30 Series
 - c. 3rd Coat: S-W ProMar 200 Zero VOC Interior Latex Flat, B30 Series
- E. Existing Hollow Metal Doors & Frames
 1. Satin/Egg Shell Finish
 - a. 1st Coat: S-W Pro Industrial Pro Cryl Universal Primer, B66 Series
 - b. 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series
 - c. 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series
- F. New Hollow Metal Doors & Frames
 1. Satin/Egg Shell Finish
 - a. 1st Coat: S-W Pro Industrial Pro Cryl Universal Primer, B66 Series
 - b. 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series
 - c. 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series

2.3 EXTERIOR FINISH PAINT MATERIAL:

- A. New Galvanized Metal Handrail
 - 1. Semi-Gloss Finish
 - a. 1st Coat: S-W Pro Industrial Pro Cryl Universal Primer, B66 Series
 - b. 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series
 - c. 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53 Series

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Test surfaces for moisture, alkalinity, and similar conditions affecting paint performance.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space have items reinstalled by workers skilled in the trades involved.
 - 1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect/Engineer in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
 - 2. Do not apply specified coats until all surface damage and all shop prime coats have been repaired.
 - 3. Cementitious Materials: Prepare concrete surfaces. Remove efflorescence, chalk, dust, dirt, grease, oils and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods or surface preparation.
 - 4. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - 5. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - 6. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - 7. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fillholes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 8. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove rust, oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
 - 9. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with primer similar to shop coat.
 - 10. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock with mechanical methods.
- C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions and best practices of paint trade. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- D. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat. Omit this requirement for surfaces normally subject to wear, such as floors and handrails; tint undercoats to match top coat.

3.3 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicator and techniques best suited for substrate, type of material being applied, and project conditions. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Verify compatibility of field-applied paint with primers used.
 - 1. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

2. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 3. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 4. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting:** Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- C. Minimum Coating Thickness:** Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- D. Prime Coats:** Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- E. Brush Application:** Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags ropiness or other surface imperfections. Neatly draw glass lines and color breaks.
1. Apply primers and first coats by brush unless the manufacturer's instructions permit use of mechanical applicators.
- F. Completed Work:** Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

- A.** The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:

Quantitative materials Analysis	Accelerated weathering
Abrasion resistance.	Dry opacity
Apparent reflectivity.	Accelerated yellowness.
Flexibility.	Recoating.
Washability	Skinning.
Absorption.	Color retention.
	Alkali and mildew resistance.
 2. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible.

3.5 CLEANING

- A.** Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A.** Protect work of other trades, to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect/Engineer.
- B.** Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

**THIS PAGE
BLANK**

DIVISION 14 24 00 – HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1. SUMMARY

- A. Section includes modernization of hydraulic elevators as follows:
 - 1. One (1) passenger elevator, South Elevator, ID 6479.
- B. Products Installed but Not Furnished Under This Section:
 - 1. Emergency Voice/Alarm Communication System Provisions.
 - 2. Car interior finishes.
 - 3. Car flooring.
 - 4. Internet connectivity in each elevator machine room or controller space.

1.2. DEFINITIONS

- A. Technical terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1. or in this section.
- B. ELEVATOR CONSULTANT or CONSULTANT refers to Lerch Bates Inc. (Lerch Bates).
- C. PROVIDE means “furnish and install.”
- D. MANUFACTURER means either the Original Equipment Manufacturer (OEM) or the principal manufacturer of a component or system.
- E. RETAIN means, unless otherwise specified, the existing equipment is to be left in place with no alterations and no change in the original manufacturer’s designed performance or functionality. Items that are “retained” shall be thoroughly cleaned in place and adjusted to achieve originally designed function.
- F. REFURBISH means, unless otherwise specified, the existing equipment is to be cleaned, repainted, repaired, and parts replaced to put the equipment into a condition to provide the same appearance, performance, and functionality as the equipment provided when it was originally installed. Unless otherwise specified, the scope of replacement of components is limited to those items currently available for purchase as replacement parts from the manufacturer or after-market suppliers approved by the manufacturer.
- G. REUSE means that the Contractor shall carefully remove equipment from the existing installation, avoiding any damage or additional wear. Store in a safe location to maintain equipment in its pre-removal condition. Reinstall and incorporate into the modernized elevator installation using the same procedures and recommendations provided by the manufacturer of the equipment.
- H. CALL BACK means a request from the Owner to the Contractor to provide a technician on site to evaluate an elevator that is out of service or not functioning properly, rectify the root cause of the malfunction, and place the unit back into normal service.
- I. INCLUDES or INCLUDING means including the items specified but not limited solely to those items if additional work or components are required to achieve the specified outcome.
- J. Words in the singular shall include the plural whenever applicable or context so indicates.

1.3. WORK INCLUDED

- A. Provide all labor, engineering, tools, transportation, services, supervision, materials, and equipment necessary for and incidental to satisfactory completion of required work as indicated in Contract Documents.
- B. Provide all required staging, hoisting and movement of new equipment, reused equipment, or removal of existing equipment.
- C. Applicable conditions of Owner's General, Special, and Supplemental Conditions.
- D. Scope of work includes, but is not limited to, the following:
 - 1. Coordination, scheduling, and management of work of component suppliers and subcontractors.
 - 2. Furnish and install equipment as specified, utilizing existing and/or modified hoistways and newly constructed machine room.
 - 3. Containment, storage, transport, and disposal of all used hydraulic oil and jack hole clean out spoils and debris removed from the existing jack hole at no extra cost to the Owner.
 - 4. Drilling and installation of new jack and cylinder.
 - 5. Patch/Repair concrete around newly installed hydraulic jack.

1.4. RELATED WORK COORDINATION

- A. General:
 - 1. Coordinate the following requirements with other trades.
- B. Machine Room Construction:
 - 1. Coordinate the construction of the newly designed machine room based on the provided drawings.
- C. Cast-in-Place Concrete:
 - 1. Provide other hoistway and pit requirements, including location of sump pits.
 - 2. Removal of concrete in pit for installation of new jack.
 - 3. Concrete repair and replacement around new hydraulic jack assembly in pit.
- D. Masonry Penetrations:
 - 1. Provide locations in elevator machine room/hoistway walls where conduit, ropes, etc. shall penetrate walls and slabs.
 - 2. Coordinate installation of sleeves, block outs, inserts, and items that are embedded in concrete or masonry for elevator equipment.
 - 3. Furnish inserts, templates and installation instructions and deliver to Project site in time for installation.
- E. Structural Steel:
 - 1. Including, but not limited to, elevator machine rooms, hoistways and pits, sill supports, rail supports.
- F. Miscellaneous Steel:
 - 1. Pit ladders, working platforms, inspection platforms, guard rails, divider beams.
- G. Electric:
 - 1. Electrical service, outlets, lights, switches in elevator machine rooms and pits.

- H. HVAC:
 - 1. Provide necessary information to General Contractor and coordinate installation of equipment for elevator machine rooms.
- I. Finishes:
 - 1. Cab interiors, hoistway entrances, fixtures.
- J. Elevator Cab Flooring:
 - 1. Material and finish to be specified in other applicable section.
 - 2. Flooring installation must be coordinated to ensure car saddle is installed at proper height (even with finished floor).
- 1.5. SOURCE QUALITY CONTROL
 - A. Country of Origin: Submit list of all major original equipment manufacturer components identifying origin of each component.
- 1.6. ACTION AND INFORMATIONAL SUBMITTALS
 - A. Within forty-five calendar days after award of contract and before beginning equipment fabrication submit field verified existing installation information for review.
 - 1. Hydraulic Car Information:
 - a) Existing Total Car Weight:
 - 1) Documented on crosshead data tag, all cars.
 - 2) Field Verified: weigh single cars and one car per group of each identical duty type.
 - b) Estimated Gross Load on Jack
 - 2. Power Confirmation Information: Field verified existing conditions at each elevator main disconnect:
 - a) Actual maximum available voltage and current.
 - b) Verify true earth ground value.
 - B. Within forty-five calendar days after award of contract and before beginning equipment fabrication submit planned modernization design information, shop drawings, and required material samples for review. Allow thirty calendar days for response to initial submittal.
 - C. Indicate equipment lists, reactions, and design information on layouts, including:
 - 1. Car:
 - a) Total car weight to be included on new crosshead data tag.
 - b) Written confirmation that designed modernization total combined weight of car and rated load:
 - 1) Is no more than the existing installation and no less than 95% of the existing installation.
 - c) Verify buffer capacity via data tags or known manufacturing data.
 - 2. Power Confirmation Information: Design for existing conditions.
 - a) Motor horsepower and code letter designation.

- b) Motor starter in-rush current, full load running current, and demand factor.
 - c) Engineered power consumption based on hydraulic elevator with [HYDRAULIC UP STARTS] upstarts per hour full load.
 - d) Written confirmation that existing electrical provisions are adequate for post modernization installation equipment requirements.
- 3. Written confirmation that total planned modernization reactions on building structure do not exceed originally designed reactions by more than 5%. If installation has been altered previously and original car top data tag is missing, confirm that new reactions will not exceed existing reactions. Reaction calculations shall include:
 - a) Gross Load on Jack.
 - b) Traveling Cables.
 - c) Total Car Weight.
 - d) Car Capacity.
- 4. Product Data, Including:
 - a) Capacities, sizes, performances, operation, control, signal systems operations, safety features, finishes, and similar information.
 - b) Product data for car enclosures and hoistway entrances.
 - c) Product data for signal fixtures, lights, graphics, tactile marking plates, and details of mounting.
 - d) Full details of ascending car protection means and installation.
 - e) Two-way conversation devices.
 - f) Post-modernization machine room heat emissions in BTU.
- D. Shop Drawings:
 - 1. Scaled or Fully Dimensioned Layout: Plan of machine room indicating equipment arrangement, details of car enclosures, hoistway entrances, and car/hall signal fixtures.
 - 2. Fully Dimensioned Fixture Drawings:
 - a) Car operating panels.
 - b) Car floor indicators.
 - c) Hall stations.
 - d) Destination/landing input stations.
 - e) Position indicators.
 - f) Hall lanterns.
 - g) Access key switch.
 - h) Remote panels.
 - i) Firefighter's control panel.
 - j) Emergency power selector switches.

- E. Samples for Initial Selection: For finishes involving surface treatment or paint.
- F. Samples for Verification:
 - 1. For exposed car, hoistway door and frame, and signal equipment finishes.
 - 2. Samples of Sheet Materials: 3" (75 mm) square.
 - 3. Running Trim Members: 4" (100 mm) lengths.
 - 4. Include full component samples, if requested:
 - a) Signal fixtures.
 - b) Lighting.
 - c) Graphics.
 - d) Braille plates.
- G. Written Maintenance Control Program (MCP) specifically designed for the equipment included under this contract.
 - 1. Include any unique or product specific procedures or methods required to inspect or test the equipment.
 - 2. Identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.
- H. Submittal review shall not be construed as an indication that submittal is correct or suitable or that the work represented by submittal complies with the Contract Documents. Compliance with Contract Documents, Code requirements, dimensions, fit, and interface with other work is Contractor's responsibility.
- I. Acknowledge and/or respond to review comments within fourteen calendar days of return.
 - 1. Promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected.
 - 2. Identify and cloud drawing revisions including Contractor elective revisions on each re-submittal.
- J. Contractor's revision response time is not justification for equipment delivery or installation delay.

1.7. CLOSEOUT SUBMITTALS

- A. Manufacturer's Warranty:
 - 1. Provide documentation of Manufacturer's Warranty in compliance with Contract Documents.
- B. Owner's Information:
 - 1. Provide electronic copies (flash drive or Consultant-approved equivalent) of written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance. Final retention will be withheld until data is received and reviewed by Consultant. Include the following as minimums:
 - a) Straight-line wiring diagrams of "as-installed" elevator circuits with index of location and function of components. Provide one set reproducible master. Mount one set wiring diagrams on panels, racked, or similarly protected, in elevator machine room. Provide remaining set rolled and in a protective drawing tube. Maintain all drawing sets with addition of all subsequent changes. These diagrams are Owner's property.

- b) Written Maintenance Control Program (MCP) specifically designed for the equipment included under this contract. Include any unique or product-specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.
 - c) Lubrication instructions, including recommended grade of lubricants.
 - d) Parts catalogs for all replaceable parts, including ordering forms and instructions.
 - e) Instructions explaining all operating features, including all apparatus in the car and lobby control panels.
 - f) Maintenance Control Program documentation for all equipment.
- C. Provide Owner with the following:
- 1. Any interface cards required for equipment maintenance, code mandated testing, and troubleshooting.
 - 2. Four sets of keys for all switches and control features properly tagged and marked.
 - 3. Diagnostic equipment complete with access codes, adjusters' manuals, and set-up manuals for adjustment, diagnosis, and troubleshooting of elevator system, and performance of routine safety tests.

1.8. PERMITS, TESTS, AND CERTIFICATES

A. Permits:

- 1. Secure and pay for all permits required for Work to be performed, including but not limited to:
 - a) Municipal and State permits.
 - b) Device or equipment removal permits.
 - c) Hot works permits.
 - d) Confined space access permits.
 - 2. Post, maintain, and renew all permits in compliance with local governmental requirements.
 - 3. Obtain final close-out of all required permits.
 - 4. Tests and Inspections: Schedule with the AHJ and perform tests required by Governing Authority in accordance with procedure described in ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks in the presence of Authorized Representative of the AHJ.
- B. Certificates: Obtain, pay for, and deliver to purchaser with all temporary and final inspection certificates provided by proper governing authorities.
- C. Violations: Resolve any outstanding violations on record with the AHJ on devices being removed prior to final acceptance by the purchaser.

1.9. QUALITY ASSURANCE

- A. Compliance with Regulatory Agencies: Comply with most stringent applicable provisions of currently enforced codes, laws, and/or authorities, including revisions and changes in effect including, but not limited to:
- 1. American Society of Mechanical Engineers:
 - a) ASME A17.1, Safety Code for Elevators, Escalators, and Moving Walks.

- b) ASME A17.2, Guide for Inspection of Elevators, Escalators, and Moving Walks.
 - c) ASME A17.5, Elevator and Escalator Electrical Equipment.
 - d) ASME A17.6, Standard for Elevator Suspension, Compensation, and Governor Systems.
 - e) ASME A17.7, Performance Based Safety Code for Elevators, Escalators, and Moving Walks.
- 2. National Fire Protection Association (NFPA):
 - a) NFPA 70, National Electric Code.
 - b) NFPA 80, Fire Doors and Windows.
 - c) NFPA 101, Life Safety Code.
 - d) NFPA 13, Installation of Sprinkler Systems.
- 3. International Building Code (IBC).
- 4. Accessibility:
 - a) American National Standard Institute (ANSI): A117.1, Accessible and Usable Buildings and Facilities.
 - b) ADAAG, Americans with Disabilities Act Accessibility Guidelines.
- 5. Local Codes:
 - a) State of Michigan Code Requirements.
- B. Inspections: Provide access to areas where work is being performed for the consultant and purchaser at any time throughout the project.

1.10. MAINTENANCE

A. WARRANTY MAINTENANCE

- 1. Provide preventive maintenance and 24-hour emergency callback service for one year commencing on date of final acceptance of all modernized elevators by Owner. Monthly examine, adjust, clean, and lubricate all equipment. Repair or replace defective parts using parts produced by the Contractor of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition.
- 2. Use competent personnel, acceptable to the Owner, supervised and employed by Contractor.

1.11. DELIVERY AND STORAGE

- A. The protection of all equipment and exposed finishes shall be the responsibility of the Elevator Contractor during delivery, handling, and installation until completion of project.
- B. The Elevator Contractor shall replace damaged materials with new at no additional cost for material and labor to Owner.
- C. Manufacturers' original packing must adequately protect materials during delivery.
- D. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered materials shall be identical to accepted samples.
- E. Store materials in original protective packaging under cover in a dry and clean location off the ground. Remove delivered materials that are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.

- F. It is the responsibility of the Contractor to properly store and protect all materials in space provided or designated by the Owner against damage, stains, scratches, corrosion, weather, construction debris, and environmental conditions.

PART 2 - PRODUCTS

2.1. MANUFACTURERS AND PRODUCTS

A. Approved Elevator Systems:

1. Approved subject to compliance with the requirements of the contract, provide products by one or more of the following Principal Manufacturers. Where specific product models are referenced below only those specific product models or types are approved.

- a) Otis.
- b) Schindler.
- c) TK Elevator.
- d) Canton Elevator.

B. Approved Elevator Components In addition to products manufactured by the Principal Manufacturers specified above, the following Manufacturers are approved for the specific components listed below, subject to the requirements of the contract:

1. Controllers:

- a) GAL (Vantage).
- b) MCE (Nidec).
- c) Smart Rise.

2. Hydraulic Machines (Power Units):

- a) EECO.
- b) Maxton.
- c) IMO.
- d) Bore-Max (Vantage)

3. Hydraulic Jack Assemblies:

- a) EECO.
- b) D.L. Martin.
- c) Nidec (Canton).

4. Hoistway Entrances:

- a) Columbia.
- b) EDI-ECI.
- c) National Elevator Cab and Doors.
- d) Regency Elevator Cabs.
- e) Wittur.

5. Passenger Elevator Door Equipment (Operators, Tracks, Hangers, and Closers):

- a) GAL.
- b) Wittur.
- 6. Elevator Car Enclosures (Cab Shells):
 - a) Cab Works.
 - b) Gunderlin.
- 7. Cab Interior Finishes (Standard/Pre-Engineered/Cab Systems):
 - a) FabACab.
 - b) Cab Works.
 - c) Columbia Eelevator.
 - d) National Elevator Cab & Door Corp.
 - e) SnapCab.
 - f) Elevator Cabs, Inc (ECI).
 - g) Gunderlin.
- 8. Car and Hall Signal Fixtures:
 - a) EPCO.
 - b) Innovation.
 - c) MAD Fixtures.
 - d) Monitor.
 - e) National Elevator Cab and Doors.
- 9. Two-Way Audio Communication Device:
 - a) Janus/Rath.
 - b) Wurtec.
 - c) Janus/Rath.
 - d) Wurtec.
- 10. Door Edge Detector with Approaching Object Detection:
 - a) CEDES.
 - b) Janus.

2.2. MATERIALS

A. Steel:

- 1. Sheet Steel (Furniture Steel for Exposed Work): Stretcher-leveled, cold-rolled, commercial quality carbon steel, complying with ASTM A366, matte finish.
- 2. Sheet Steel (for Unexposed Work): Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568/A568M-03.
- 3. Structural Steel Shapes and Plates: ASTM A36.

- B. Stainless Steel: Type 302 or 304 complying with ASTM A240, with standard tempers and hardness required for fabrication, strength, and durability. Apply mechanical finish on fabricated work in the locations shown or specified, Federal Standard and NAAMM nomenclature, with texture and reflectivity required to match Architect's sample. Protect with adhesive paper covering.
 - 1. No. 4 Satin: Directional polish finish. Graining directions as shown or, if not shown, in longest dimension.
 - 2. No. 8 Mirror: Reflective polish finish with no visible graining.
 - 3. Textured: 5WL as manufactured by Rigidized Metals or Windsor pattern as manufactured by Rimex Metals or approved equal with .050" mean pattern depth with bright directional polish (satin finish).
 - 4. Burnished: Non-directional, random abrasion pattern.
- C. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.
- D. Plastic Laminate: ASTM E84 Class A and NEMA LD3.1, Fire-Rated Grade (GP-50), Type 7, 0.050" ±.005" thick, color and texture as follows:
 - 1. Exposed Surfaces: Color and texture selected by Architect.
 - 2. Concealed Surfaces: Contractor's standard color and finish.
- E. Fire-Retardant Treated Particle Board Panels: Minimum 3/4" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as shown, provided with suitable anti-warp backing; meet ASTM E84 Class "T" rating with a flame-spread rating of 25 or less, registered with Local Authorities for elevator finish materials.
- F. Natural Finish Wood Veneer: Standard thickness, 1/40" thoroughly dried conforming to ASME/HPMA HP-1983, Premium Grade. Place veneer, tapeless spliced with grain running in direction shown, belt and polish sanded, book-matched. Species and finish designated and approved by Architect.
- G. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.
- H. Prime Finish: Clean all metal surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.
- I. Baked Enamel Finish: Prime finish per above. Unless specified "prime finish" only, apply and bake three additional coats of enamel in the selected solid color.
- J. Entrance Field Paint:
 - 1. Clean all surfaces to remove dirt and grease.
 - 2. Sand and finish surfaces as necessary to remove pits and scratches and prepare surface for painting.
 - 3. Apply filler to ensure smooth surface; sand and apply one coat of electrostatic enamel in the selected solid color.
- K. Refinishing of natural metals: Remove existing protective finish. Buff as necessary to remove scratches. Regrain or finish as specified and protect as indicated for particular metal type.
- L. Entrance Support Equipment within Hoistway: Include strut angles, headers, sill support angles, fascia, hanger covers, etc.

1. Clean, remove, and check for corrosive activity. Replace components which exhibit severe deterioration.
 2. Tighten all fastenings.
- M. Glass: Laminated safety glass, minimum 9/16" thick, conforming to ANSI Z97.1 and CPSC 16 CFR Part 1201.

PART 3 - PERFORMANCE AND OPERATION

3.1. PERFORMANCE REQUIREMENTS

- A. Car Speed: Allowable variance from contract speed of no more than +/- 10% in the up direction and +/-10% in the down direction under any loading condition.
- B. Car Capacity: Safely lower, stop, and hold 125% of rated load.
- C. Car Stopping Zone: $\pm 1/4$ " under any loading condition.
- D. Door Times: Seconds from start to fully open or fully closed:
 - 1. Door Open: 2.3 seconds. Door Close: 4.0 seconds.
- E. Car Floor-to-Floor Performance Time: Seconds from start of doors closing until doors are 3/4 open for center-opening doors or 1/2 open for side-opening doors, and car is level and stopped at next successive floor under any loading condition or travel direction:
 - 1. 15.5 seconds.
- F. Noise and Vibration Control:
 - 1. Airborne Noise:
 - a) Measured noise level of elevator equipment and its operation shall not exceed 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.
 - b) Limit noise level in the machine room and control space relating to elevator equipment and its operation to no more than 80 dBA.
 - c) All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment using the "A" weighted scale.
 - 2. Vibration Control: Mechanically isolate all new elevator equipment from the building structure and other components. Minimize objectionable noise and transmission of vibrations to occupied areas of the building.

3.2. ELEVATOR OPERATION REQUIREMENTS

- A. General:
 - 1. Cars automatically slow down and stop level at floors in response to car and landing calls with stops made in sequence in the established direction of travel, regardless of order in which buttons are pressed.
 - 2. Landing calls are canceled when the assigned car arrives at the landing.
 - 3. Automatic Dispatch Failure: Provide auxiliary dispatch system to automatically dispatch elevators in the event of failure of the primary control system.
 - 4. Hall Call Button Failure: Should failure of hall call button system occur, initiate operation providing predetermined service to all landings; elevators respond normally to car calls.
 - 5. Automatic Leveling:
 - a) When arriving at a floor cars level to within 1/8" above or below the landing sill prior to opening doors, without travelling past the landing during leveling
 - b) Maintain leveling accuracy regardless of carload, direction of travel, rope slippage or stretch.

B. Door Operation:

1. Passenger Elevator:

- a) Automatically open doors when car arrives at a floor.
- b) Stop and reopen doors or hold doors in open position upon activation of “door open” button.
- c) At expiration of normal dwell time, or upon activation of “door close” button, close doors:
 - 1) Prevent doors from closing and reverse doors at normal opening speed if door reopening device beams are obstructed while doors are closing, except during nudging operation.
 - 2) In event of door reopening device failure, provide for automatic shutdown of car at floor level with doors open
 - 3) Close cycle does not begin upon activation of “door close” button until normal door dwell time for a car or hall call has expired, except firefighters’ operation.
- d) Nudging Operation:
 - 1) After beams of door reopening device are obstructed for a predetermined time interval (minimum 20.0-25.0 seconds), sound warning signal, and attempt to close doors with maximum of 2.5 foot-pounds kinetic energy.
 - 2) Activation of the door open button overrides nudging operation and reopens doors.
- e) Interrupted Beam Time:
 - 1) When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds.
 - 2) When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0 1.5 seconds after beams are reestablished.
- f) Differential Door Time:
 - 1) Field adjustable time that doors remain open after stopping in response to calls.
 - 2) Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
 - 3) Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds.
- g) Use hall call time when car responds to coincidental calls.
- h) Reopen doors when car is designated for loading.

C. Independent Service.

- 1. When feature is activated from within the car allow control of car only from buttons and controls inside the car.
- 2. Close doors by constant pressure on desired destination floor button or door close button.

D. Selective Collective Operation, Single Car:

- 1. Elevators operate via momentary pressure buttons to:
 - a) Place hall call by selecting direction of travel at each hall landing (up and down buttons at each intermediate landing, single buttons at each terminal landing).

- b) Place car call by selecting destination floor from inside the car (individual buttons for each floor served).
- 2. Hall calls, other than calls placed at the landing at which car is standing, start car, and cause the car to stop at first landing for which a call is registered in the direction of travel.
- 3. Stops are made in order in which landings are reached, irrespective of sequence in which calls are registered.
- 4. Parked Car (No Demand):
 - a) When feature is enabled elevator remains at landing of last assignment (if no further demand) with doors closed, for a predetermined amount of time (programmable for any amount of time). Upon expiration of time, the elevator returns to the main egress landing with the doors closed.
 - b) If feature is disabled, if no further demand, the elevator remains at landing of last assignment with the doors closed until a hall call is registered.
- 5. Car and Hall Lanterns:
 - a) Lanterns provide audio and visual signal upon each stop, regardless of responding to car or hall call.
 - b) Visual signal remains active from commencement of door opening until doors are completely closed.
- E. Battery Rescue Operation:
 - 1. Upon loss of normal power automatically lower the car to the nearest landing depending on the load in the car.
 - 2. Upon arrival at the landing, the elevator doors shall open automatically and remain open until regular door time has expired; the elevator shall then be removed from service.
 - 3. Upon restoration of normal power, the elevator shall automatically resume normal operation.
- F. Firefighters' Emergency Operation: Provide equipment and operation in accordance with applicable code requirements. Replace all Firefighters Emergency Operation key switches that control non-modernized elevators in this building to match modernized elevators when first car in group is returned to service.
- G. Battery Backup Operation for Emergency Lighting, Communication, and Alarm:
 - 1. Car mounted battery unit with solid-state charger to operate alarm bell, car emergency lighting, and voice communication system.
 - 2. Car lighting and communication shall be provided with a minimum of 4 hours of operation on back-up power during a loss of normal power, and a minimum of 1 hour of operation for car-mounted alarm, and any remote alarm mounted at the designated floor level.
 - 3. Battery to be rechargeable with minimum five-year life expectancy.
 - 4. Provide constant pressure test button in service compartment of car operating panel.
 - 5. Provide lighting integral with portion of normal car lighting system.
- H. Emergency Car Communication System Operation:
 - 1. Comply with all requirements of ASME A17.1 2016 , or later editions if adopted by the AHJ.
 - 2. Hands-Free Communication System:

- a) In Car System:
 - 1) Hands-free two-way audio communication system in each elevator car.
 - 2) Automatic dialer to include automatic rollover capability if call is not answered with minimum two numbers.
 - 3) Intercom type systems shall be capable of auto dialing out of the building to any active telephone number selected by Owner if intercom call is not answered.
 - 4) Means to identify building and car for Authorized Personnel and Emergency Personnel on demand.
 - 5) Activated by button in car identified with “PHONE” symbol or by external telephone call.
 - 6) Adjacent light jewel illuminates and flashes when call is acknowledged.
- 3. Authorized Personnel Communication:
 - a) Communication system allows authorized personnel, via phone or intercom system, inside the building or at an outside location, to establish verbal communications with each elevator individually.

PART 4 - ELEVATOR ALTERATIONS

4.1. HYDRAULIC PASSENGER ELEVATOR:

ALTERATION SUMMARY		
South Elevator:	EXISTING INSTALLATION	MODERNIZED INSTALLATION
Capacity:	3000 lbs.	3000 lbs.
Class of Loading:	Class A	Class A
Duty Type:	Passenger	Passenger
Contract Speed:	50 fpm	125 fpm
Hydraulic Jack Type:	Current Traction Elevator	In Ground
Machine Type:	Geared	Submersible Power Unit
Cylinder Hole	Not applicable	Jack Hole, Schedule 40 PVC or HDPE with endcap Outer Casing and Watertight PVC Inner Casing Mylar tape or coated with an asphaltic application with Secondary Containment
Machine Location:	Overhead at top landing	Remote at lowest landing
Operation Control:	Two-Button Selective Collective	Two-Button Selective Collective
Floors Served:	B, 1-3 Front Only	B, 1-3 Front Only
Total Entrances:	4, Front Only	4, Front Only
Car Entrance Type:	Collapsible Gate Front	Single Speed Side Opening (SSSO) Front
Hoistway Entrance Type:	Two Speed Side Opening (2SSO) Manual Doors Front	Single Speed Side Opening (SSSO) Front
Entrance Size:	48" Wide x 84" (7'-0") High	42" Wide x 84" (7'-0") High
Minimum Clear to Underside of Canopy:	7'-6" High	8'-0" High

4.2. MACHINE ROOM EQUIPMENT

- A. Provide and arrange equipment as shown on approved drawings in newly constructed machine room.
- B. Identification: Permanently identify (painted on or securely attached) machine room equipment with minimum 3" characters corresponding to elevator identification.
 - 1. Power Unit.
 - 2. Transformer, choke/filter.

3. Controller.
4. Main line disconnect switch.
5. Elevator hoistway pit equipment.
- C. Hydraulic Machine (Power Unit):
 1. New:
 - a) Assembled unit mounted on isolating pads consisting of:
 - 1) Dry or submersible type positive displacement pump and induction motor.
 - 2) Dry type only with motors exceeding 50 hp.
 - 3) Master-type control valves combining:
 - 4) Safety features.
 - 5) Holding, direction, bypass, stopping, manual lowering functions.
 - 6) Shut off valve.
 - 7) Oil reservoir with protected vent opening.
 - 8) Oil level gauge.
 - 9) Outlet strainer.
 - 10) Drip pan.
 - 11) Muffler.
- D. Motor Starter:
 1. Soft start type unit including:
 - a) Integral electronic overload protection.
 - b) Integral bypass.
- E. Muffler:
 1. In discharge oil line near pump unit.
 2. Design shall dampen and absorb pulsation and noise in the flow of hydraulic fluid.
- F. Piping and Oil:
 1. All piping, connections and oil required for the elevator system.
 2. Buried piping shall be secondarily contained with watertight Schedule 80 PVC sleeves between elevator machine room and pit.
 3. A minimum of two sound isolation couplings shall be provided between the pump unit and oil line and the oil line and jack unit.
 4. Provide 2-90° joints to reduce vibration and create wave diffraction.
 5. Provide isolated pipe stands or hangers.
- G. Shut-Off Valve:
 1. Oil line shut off valve in the machine room or accessible from outside the hoistway.

2. Second valve in pit adjacent to jack unit.
- H. Battery Rescue System:
 1. Auxiliary power source shall be provided via 12-volt D.C. battery units installed in machine room or controller space.
 2. Include solid-state charger and testing means mounted in a common metal container.
 3. Battery to be rechargeable lead acid or nickel cadmium with a ten-year life expectancy.
- I. Controller: UL/CSA labeled:
 1. Compartment:
 - a) Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame.
 - b) Completely enclose equipment with covers. Provide means to prevent overheating.
 2. Relay Design:
 - a) Magnet operated with contacts of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear.
 - b) Provide wiping action and means to prevent sticking due to fusion.
 - c) Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
 3. Microprocessor-Related Hardware:
 - a) Provide built-in noise suppression devices providing a high level of noise immunity on all solid-state hardware and devices.
 - b) Provide power supplies with noise suppression devices.
 - c) Isolate inputs from external devices (such as pushbuttons) with opto-isolation modules.
 - d) Design control circuits with one leg of power supply grounded.
 - e) Safety circuits are not to be affected by accidental grounding of any part of the system.
 - f) System automatically restarts when power is restored.
 - g) System memory is retained in the event of power failure or disturbance.
 - h) Equipment is provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
 4. Wiring:
 - a) CSA labeled copper for factory wiring.
 - b) Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
 5. Permanently mark components (relays, fuses, PC boards, etc.) with symbols shown on wiring diagrams.
- J. Auxiliary disconnect: Provide controller or power unit mounted auxiliary, lockable "open," disconnect if mainline disconnect is not in sight of controller and/or machine.

4.3. HOISTWAY AND PIT EQUIPMENT

- A. Provide and arrange equipment in existing hoistway and pit spaces.
- B. Hydraulic Jack Assembly:
 - 1. New:
 - a) Single jack in ground application.
 - b) Cylinders:
 - 1) Seamless steel pipe.
 - 2) Design head to receive unit-type packing and provide means to collect oil at cylinder head and return automatically to oil reservoir.
 - 3) Provide secondary containment and cylinder corrosion protection in compliance with applicable code requirements.
 - 4) Design shall include:
 - 1) Polished seamless steel tubing or pipe.
 - 2) If plunger length exceeds 24'-0", provide two or more sections not exceeding 16'-0" in length, or coordinate installation of longer unit at the jobsite.
 - 3) Join sections by internal threaded couplings.
 - 4) Multiple section jack units shall be factory polished while assembled and marked.
 - 5) Isolate plunger from car frames.
 - c) Cylinder stabilizer bracketing between guide rails as required. Plunger:
 - 1) Polished seamless steel tubing or pipe.
 - 2) If plunger length exceeds 24'-0", provide two or more sections not exceeding 16'-0" in length, or coordinate installation of longer unit at the jobsite.
 - 3) Join sections by internal threaded couplings.
 - 4) Multiple section jack units shall be factory polished while assembled and marked.
 - 5) Isolate plunger from car frames.
- C. Jack Support:
 - 1. New:
 - a) Steel pit channels to support jack assembly and transmit loads to building structure.
 - b) Intermediate stabilizers as required.
- D. Shut-Off Valves:
 - 1. New:
 - a) Manual on/off valves in oil lines adjacent to pump unit and jack units in pit.
- E. Guide Rails:
 - 1. New:
 - a) Contractor may elect to provide new guide rails at no additional cost to the owner. Planed steel T-sections for car, including brackets for attachment to building structure. Provide rail backing and intermediate tie brackets to meet code requirements. No additional structural points of rail attachment, other than the existing condition and those shown on the Contract Documents, will be provided.
- F. Buffer:
 - 1. New:
 - a) Spring type with blocking and support channels.

- G. Access Ladders and Platforms: Provide permanent buffer and car safety access ladders and platforms if required to comply with Code requirements.
 - H. Terminal Stopping Devices:
 - 1. New:
 - a) Normal and final devices.
 - I. Electrical Wiring and Wiring Connections:
 - 1. Conductors and Connections:
 - a) Copper throughout with individual wires coded and connections on identified studs or terminal blocks.
 - b) Use no splices or similar connections in wiring except at terminal blocks, control compartments, or junction boxes.
 - 2. Conduit:
 - a) Galvanized steel conduit, EMT, or duct.
 - b) Flexible conduit length not to exceed 3'-0".
 - 3. Traveling Cables:
 - a) Provide multiple traveling cables per elevator if necessary to meet conductor and data transmission requirements. Include the following:
 - b) Include all conductors needed for specified elevator operation and code required spares.
 - c) Provide the following additional data transmission conductors. (Draka Type ETT round travelling cable or approved equal with lifetime product warranty)
 - 1) A minimum of 12 pairs of twisted shielded 14 AWG copper twisted shielded pairs.
 - 2) Provide 20% spares of all other travel cable wiring.
 - d) Tag spares in controller space.
 - e) Provide cables from controller to car top.
- 4.4. HOISTWAY DOOR OPERATING EQUIPMENT
- A. Horizontal Sliding Passenger Entrances:
 - 1. Door Hangers, Hoistway:
 - a) New:
 - 1) Two-point suspension design.
 - 2) New rollers with neoprene roller surface.
 - 3) Eccentric upthrust roller adjustment.
 - 2. Door Tracks, Hoistway:
 - a) New:
 - 1) Bar or formed with smooth roller contact surface.
 - 2) Constructed of cold drawn steel.

3. Hoistway Door Interlocks and Pick-up Roller Assemblies:
 - a) New.
 4. Hoistway Door Closers:
 - a) New:
 - 1) Spring activated spirator type.
 5. Hoistway Door Unlocking Devices:
 - a) New:
 - 1) Include all drilling and ACM containment on existing door panels.
 - 2) Unlocking device including new escutcheon at all floors.
 6. Hoistway Access Switches:
 - a) New:
 - 1) Top and bottom floors.
 - 2) Mount in wall located within easy reach of entrance to allow safe car top access by one person.
 - 3) Provide switch with faceplate.
 7. Door Closed Detection:
 - a) Electrical contacts or a SIL rated device to detect closed position of hoistway doors.
 - b) Design and operation to comply with ASME A17.1 2019 or later edition.
 - B. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors or hoistway fascia in location visible from within car.
- 4.5. HOISTWAY ENTRANCE FRAMES AND DOOR PANELS
- A. Provide and arrange equipment in same location as existing entrances.
 - B. Passenger Elevator Entrance Frames:
 1. New:
 - a) 14-gauge hollow metal at all floors.
 - b) Bolted and lapped head to jamb assembly at (all floors).
 - c) Provide Arabic floor designation/tactile marking plates:
 - 1) Centered at 60" above finished floor.
 - 2) Located on both side jambs of all entrances.
 - 3) Minimum 4" high.
 - 4) Tactile marking indications shall be below Arabic floor designation.
 - 5) Permanently fastened.
 - d) Car identification:
 - 1) Mounted directly below floor designation/tactile marking plates.

- 2) Located on both side jambs at the Designated and Alternate levels:
- 3) Finish and design to match floor designation/tactile marking plates.
- 4) Permanently fastened.

C. Horizontal Sliding Hoistway Door Panels:

1. New:

- a) 16-gauge steel, sandwich or pressed with ribbed construction and without binder angles.
- b) Provide one leading edge of doors with rubber astragal.
- c) Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel.
- d) Provide one separate 4" steel reinforcement safety gib mounted between door gibs, where not integrated with door gibs.

D. Sight Guards:

1. New:

- a) 14-gauge steel.
- b) Same material and finish as hoistway entrance door panels.
- c) Construct without sharp edges.

E. Frame and Door Panel Finishes:

1. All Entrances and Doors:

- a) stainless steel satin finish.

4.6. HOISTWAY ENTRANCE SILLS AND SUPPORT

A. Sill Supports, Hoistway Entrance:

1. New:

- a) Structural or formed steel designed to support door sill based upon car loading classification.
- b) Mount to eliminate need for grout under the sill.

B. Fascia, Toe Guards, and Hanger Covers:

1. New:

- a) 14-gauge furniture steel with satin finish.
- b) Provide car door interlock in lieu of full height fascia where allowable by code.

C. Struts and Headers:

1. New:

- a) Constructed for vertical support of entrances and related material.
- b) Provide door open bumpers on entrances equipped with vertical struts.

4.7. CAR EQUIPMENT

A. Frame:

1. Retain:
 - a) Check and tighten all fastenings.
 - b) Adjust as required for plumb and square alignment.
- B. Platform:
 1. New:
 - a) Designed and constructed to accommodate load classification requirements.
 - b) Provide Class A construction.
 - c) Construction:
 - 1) Steel frame with steel stringers securely welded together.
 - 2) Two layers of 3/4" marine grade plywood on top of sheet steel securely mounted on top of frame.
 - 3) Elastomer isolation pads between plywood and steel frame.
- C. Platform Guard:
 1. New:
 - a) Extended platform guard with Contractor's standard finish to meet Code requirements.
 - b) Minimum 0.059" (1.5 mm) thick steel, or material of equivalent strength and stiffness.
 - c) Reinforced and braced to front of car platform.
- D. Car Rail Guide Roller or Shoe Assemblies:
 1. New:
 - a) Three or more 6" spring dampened, sound-deadening rollers per guide assembly.
 - b) Include renewable oilless inserts.
- E. Top of Car Guardrail:
 1. New:
 - a) Provide car top railings where fall hazard exceeds 12".
 - b) Install guardrails, necessary hardware, and toe board to meet code requirements.
- F. Car Top Control Station:
 1. Mount to provide safe access and utilization while standing on car top.
 2. Operating device with Up and Down direction buttons, a Run button, an Inspection/Automatic switch and Emergency Stop switch.
 3. Operating device provides an audible and visible indicator that fire recall has been initiated.
 4. Fix station to the car crosshead or provide portable station provided the extension cord and housing is permanently attached to the car crosshead.
 5. The car will be operated by constant pressure on the appropriate directional button and the Run button simultaneously.
 6. Normal operating devices will be inoperative while this device is in use.

- G. Car Top Emergency Audible Signal:
 - 1. Provide on top of each elevator.
 - 2. Activation of Alarm Button or Emergency Stop switch will cause Emergency Audible Signal.
 - 3. Provide auxiliary power supply to provide 1-hr. power in the event of loss of normal power.
- H. Work Light and Duplex Plug Receptacle:
 - 1. Work light on top and bottom of car.
 - 2. Car top light mounted to provide illumination of all car top equipment.
 - 3. GFCI protected duplex outlet. one (1) at top and one (1) at bottom of car.
 - 4. Include on/off switch and lamp guard.
- I. Car Sills – Passenger or Service Duty:
 - 1. New:
 - a) One-piece stainless steel metal extrusion:
 - 1) Extruded extension between car entrance columns to interior face of car front return.
 - 2) Extruded extension to match finish of sill.
 - 3) Fasteners to match sill material finish.
- J. Car Door Panels – Passenger Duty:
 - 1. New:
 - a) Fully enclosed 16-gauge steel, sandwich construction without binder angles
 - b) Constructed with interlocking, stiffening ribs.
 - c) Minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel.
 - d) Wrap Architectural metal cladding around leading and trailing edge of panel and return a minimum of 1/2" on rear side of leading edge of panel.
- K. Car Door Hangers – Passenger Duty:
 - 1. New:
 - a) Two-point hanger roller with:
 - 1) Neoprene roller surface
 - 2) Suspension with eccentric upthrust roller adjustment.
- L. Car Door Track – Passenger Duty:
 - 1. New:
 - a) Bar or formed cold-drawn steel.
 - b) Removable steel track with smooth roller contact surface.
- M. Car Door Header – Passenger Duty:
 - 1. New:

- a) Minimum 12-gauge steel.
- b) Shaped with stiffening flanges.

N. Car Door Closed Detection:

- 1. SIL rated device to detect closed position of car doors.
- 2. Design and operation to comply with ASME A17.1 2019 or later edition.

O. Car Door Interlock

- 1. Mechanical door interlock device to prevent:
 - a) Machine operation or power door opening outside of door zone.
 - b) Manual door opening from inside car outside of door zone.
- 2. Design and operation to comply with ASME A17.1 2019 or later edition.

P. Car Door Electrical Contact:

- 1. New:
 - a) Prohibit car operation unless car door or gate is closed.

Q. Door Clutch – Passenger Duty:

- 1. New:
 - a) Heavy-duty clutch, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operation.
 - b) Design clutch so car doors can be closed, while hoistway doors remain open.

R. Passenger Door Operator:

- 1. New:
 - a) High-speed, heavy-duty door Linear or Harmonic type operator capable of opening doors at no less than 2.5 fps.
 - b) Accomplish reversal in no more than 2½" of door movement.
 - c) Solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current.
 - d) Maintain consistent, smooth, and quiet car door operation at all floors, regardless of door weight or varying air pressure.

S. Passenger Door Reopening Device:

- 1. New:
 - a) Black fully enclosed infrared device with full screen infrared matrix or multiple beams extending vertically along leading edge of each door panel to minimum height of 7' 0" above finished floor.
 - b) Integral device to detect passenger or vehicle approach from elevator lobby

4.8. CAR OPERATING PANEL:

A. New:

- a) One (1) fixed car operating panel per car.
- b) Metal box containing operating fixtures mounted behind the car return panel.
- c) Vandal resistant.
- d) Provide Exposed Pushbuttons to Initiate:
 - 1) Car call registration.
 - 2) Alarm.
 - 3) Door open.
 - 4) Door close.
 - 5) Emergency push-to-call communication.
 - 6) Pushbuttons:
 - I. Provide minimum 3/4" diameter raised floor pushbuttons which illuminate to indicate call registration.
 - II. Brushed stainless buttons with illuminated LED halo.
 - III. Locate operating controls no higher than 48" above the car floor; no lower than 35" for emergency push-to-call button and alarm button.
- e) Locked Firefighters' Emergency Operation Panel:
 - 1) Openable by the same key which operates the Fire Operation switch.
 - 2) Provide panel with solenoid operated key switch which automatically opens in the event of Firefighters' Emergency Operation Phase I activation.
 - 3) Including the following features:
 - I. Phase II fire access switch.
 - II. Firefighters' visual indication.
 - III. Call cancel button.
 - IV. Stop switch, manually operated.
 - V. Door open button.
 - VI. Door close button.
 - VII. Floors served signage.
- f) Service Compartment
 - 1) Provide lockable service compartment with recessed flush door.
 - 2) Door material and finish to match car return panel or car operating panel faceplate.
 - 3) Include the following controls in lockable service cabinet with function and operating positions identified by permanent signage or engraved legend.
 - I. Access switch.

- II. Light switch.
- III. Three position exhaust blower switch.
- IV. Independent service switch.
- V. Constant pressure test button for battery pack emergency lighting.
- VI. 120-volt, AC, GFCI protected electrical convenience duplex outlet.
- VII. Card reader override switch.
- VIII. Switch to select either floor voice annunciation, floor passing tone, or chime.
- IX. Keyed stop switch.

- 2. Provide black paint filled (except as noted), engraved, or approved etched signage as follows with approved size and font:
 - a) Phase II firefighters' operating instructions on inside face of firefighters' compartment door.
 - b) Engrave filled red firefighters' operation on outside face of compartment door.
 - c) Building identification car number on main car operating panel.
 - d) Car capacity in pounds on on.
 - e) Loading classification and description on main car operating panel.

4.9. COMMUNICATION

A. Car Communication System:

- 1. Hands free two-way communication instrument in car:
 - a) Mounted behind car operating panel.
 - b) Button on car operating panel to initiate two-way communication from Car.
 - c) Match car operating panel pushbutton design.
 - d) System includes:
 - 1) Auto dialer.
 - 2) Speaker.
 - 3) Microphone.
 - 4) Adjacent light jewel that illuminates and flashes when call is acknowledged.
 - 5) Call button tactile symbol, engraved signage, and Tactile marking adjacent to button mounted integral with car front return panel.
 - 6) Rechargeable back-up battery and charging system.
 - 7) Wiring and connections between all devices inside the car and the elevator controller.

4.10. CAR ENCLOSURE AND INTERIOR FINISHES

- A. Unless specifically identified as "Retain," "Reuse," or "Refurbish," provide new equipment. Contractor may, with Consultant approval, provide new equipment in lieu of refurbishing existing. See Section 00 80 00, Supplemental Conditions.
- B. Car Enclosure (Cab Shell):

1. New:
 - a) Provide new car enclosure.
 - b) Passenger Duty:
 - 1) Enclosure Walls:

Reinforced 14-gauge textured stainless steel formed panels with light-proof joints.

Width of individual panels shall not exceed 18".

Panels reinforced and braced to provide rigid structure and securely fastened to car platform.

Apply sound-deadening mastic to exterior.
 - 2) Enclosure Canopy:

Reinforced 12-gauge steel formed panels with lockable, hinged emergency exit.
 - 3) Enclosure Walls:

Reinforced 10-gauge steel formed panels with light-proof joints.

Width of individual panels shall not exceed 20".

Panels reinforced and braced to provide rigid structure and securely fastened to car sling and platform.
 - 4) Enclosure Canopy:

Reinforced 12-gauge steel formed panels with light-proof joints and Hinged emergency exit.

Width of individual panels shall not exceed 20".
- C. Passenger Car Fronts:
 1. Car Front Returns:
 - a) New:
 - 1) 14-gauge reinforced stainless steel construction satin stainless steel finish.
 - 2) Stationary Type:
 - I. Include cutouts for car operating panels and other equipment.
 2. Front Transoms:
 - a) New:
 - 1) 14-gauge reinforced stainless steel construction satin stainless steel finish.
 - 2) Full width of car enclosure.
- D. Passenger Car InteriorWall Finishes:
 1. New:
 - a) See Owner approved drawings for custom cab interior design and construction details.
 - b) Removable panels faced and edged with satin.

- c) Satin stainless steel finish metal reveal strips fastened to enclosure between and above panels.
- E. Cab Wall Base:
 - 1. New:
 - a) Provide Owner and Consultant with drawings and submittals of cab design.
 - b) stainless steel with concealed ventilation cutouts.
- F. Handrails:
 - 1. New:
 - a) Provide Owner and Consultant with drawings and submittals of cab design.
 - b) Minimum 1½" diameter stainless steel tubular grab bar across rear and side cab walls.
- G. Lighting:
 - 1. New:
 - a) Provide Owner and Consultant with drawings and submittals of cab design.
 - b) Six (6) LED fixtures with all required wiring connections and controls.
 - c) Coordinate with emergency lighting requirements.
 - d) Provide emergency lighting integral with portion of normal car lighting system.
 - e) Recessed LED down lights with on/off switch in car operating panel. Recess mount fixture flush with inside surface of car top. Provide steel guard on car top over fixture.
- H. Suspended Ceiling:
 - 1. New:
 - a) Provide Owner and Consultant with drawings and submittals of cab design.
 - b) Six (6) section translucent plastic panels mounted in an extruded aluminum angle and T-frame.
 - c) Six (6) section satin finish stainless-steel panels with lighting cutouts in each panel.
- I. Ventilation:
 - 1. New:
 - a) Two-speed type OE exhaust blower.
 - b) Mount to car canopy on isolated rubber grommets.
 - c) Meet noise requirements specified herein.
- J. Car Finish Floor Covering:
 - 1. New:
 - a) Provided and furnished by Contractor. Finish and material to be chosen by Owner.
 - b) Accommodate a minimum 2" floor thickness.
- K. Pads and buttons
 - 1. Two pads covering side walls and adjacent front returns and one covering rear wall.

2. Provide cutouts to access main car operating panel.

4.11. HALL CONTROLS

A. Hall Pushbutton Station Fixtures:

1. Flush or surface mounted pushbutton station fixtures with to cover existing wall block out.
2. Provide any cutting and patching required.
3. Pushbuttons for each direction of travel which illuminate to indicate call registration. Provide LED illumination.
4. Separate, engraved plate with approved engraved message and pictorial representation prohibiting use of elevator during fire or another emergency.
5. Pushbutton design to match car operating panel pushbuttons.

B. Communication Operability Signals:

1. Audible and illuminated visual signals indicating telephone line or other means of communication are not operable.
2. At designated landing for each group of elevators or single elevator.
3. Included in hall pushbutton fixture or in Phase I Fire Service key switch fixture

C. Phase I Fire Service Key Switch and Signage:

1. At designated landing for this single elevator.
2. Separate fixture and faceplate or included in hall pushbutton fixture, depending on clearance with new fixture location.

4.12. CAR ARRIVAL AND TRAVEL DIRECTION SIGNALS

A. Hall Position Indicator:

1. New:
 - a) Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2½" high to indicate floor served and direction of car travel.
 - b) Provide vandal resistant indicator and light assemblies only at the designated landing.

B. Car Direction Lantern:

1. New:
 - a) Provide flush-mounted car lantern in all car entrance columns.
 - b) Illuminate up or down LED lights and sound tone once for up and twice for down direction.
 - c) Provide advanced hall lantern notification to comply with ADA hall call notification time.
 - d) Illuminate light until the car doors start to close.
 - e) Sound level shall be adjustable from 20-80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor.
 - f) Car direction lenses shall be arrow shaped with faceplates.
 - g) Lenses shall be minimum 2½" in their smallest dimension.

- h) Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.

C. Car Position Indicator:

1. New:

- a) Alpha-numeric digital indicator type.
- b) Floor designations and direction arrows a minimum of 2" high to indicate floor served and direction of car travel.
- c) Vandal resistant fixture and faceplate.
- d) Locate on car operating panel
- e) When a car leaves or passes a floor, illuminate indication representing position of car in hoistway.
- f) Illuminate proper direction arrow to indicate direction of travel.

D. Voice Synthesizer:

- 1. Provide electronic device with easily reprogrammable message and voice to announce car direction, floor, emergency exiting instructions, etc.

4.13. SIGNAL FIXTURE FACEPLATE FINISHES

A. All Fixtures:

- 1. stainless steel satin finish.

4.14. FIREFIGHTERS CONTROL AND EMERGENCY POWER PANEL

A. Provide and arrange new equipment as directed by Owner per the provided drawings.

B. Firefighters' Control Panel:

- 1. Locate in building fire control room or as directed by Contractor.
- 2. Fixture faceplate, satin finish stainless steel, including the following features:
 - a) Car position and direction indicator, digital-readout, or LCD flat screen color monitor.
 - b) Identify each position indicator with car number <>and group identification.
 - c) Indicator showing operating status of car.
 - d) Two-position firefighters' emergency return switches and indicators with engraved instructions filled red.
 - e) Firefighters' telephone jack.
 - f) Shabbat operation key switch and indication.
 - g) Flood operation reset key switch and indication, per unit provided with feature.
- 3. Where applicable, identify all indicators and manual switches with appropriate engraving.
- 4. Provide wiring and conduit to control panel.

C. Firefighters' Key Box: Flush-mounted box with lockable hinged cover. Engrave instructions for use on cover per Local Fire Authority requirements.

4.15. CLIENT INTERFACE TOOL

- A. Provide access to real-time data for elevators, including the following:
 - 1. Complete service history for all vertical transformation.
 - 2. Key performance indicators.
 - 3. Access to service request logs, disposition, and total downtime.
 - 4. Create service requests.
 - 5. View customer contracts.
 - 6. View and or accept Work Orders.
 - 7. Provide document repository.
- B. Data accessible from any device, including mobile.
- C. Confirm proper safeguards, protecting clients from malware and virus receipt.

PART 5 - EXECUTION

5.1. SITE CONDITION INSPECTION

- A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify no irregularities exist which affect execution of the specified work.
- B. Inform Owner and Consultant of any irregularities in writing prior to commencing work.
- C. Do not proceed with installation until work in place conforms to project requirements.

5.2. INSTALLATION

- A. Drill New Jack Hole:
 - a) Drill new jack hole at the correct location, with the depth and diameter required, to support the installation of a new hydraulic cylinder including required secondary containment and corrosion provisions.
 - b) Install a new steel casing and casing plug as required by applicable well drilling codes and standards.
 - c) Use appropriate drilling equipment and techniques to prevent damage to surrounding structural components.
 - 1) Verify drilling rig access path from the exterior of the building to the location required for drilling.
 - 2) Protect all floors, walls, and other building finishes during drill rig transportation, set up, drilling, and rig take down.
 - d) Contractor is responsible for the containment, storage, transport, and disposal of all spoils and debris removed during the drilling process at no extra cost to the Owner.
- B. Install all new equipment as follows:
 - 1. in accordance with Contractor's instructions, referenced codes, specifications, and approved submittals.
 - 2. with clearances in accordance with referenced codes, and specifications.
 - 3. to be easily maintained and/or removed.
 - 4. to afford maximum accessibility, safety, and continuity of operation.
- C. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
 - 1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
 - 2. Machine room equipment, and pit equipment.
 - 3. Neatly touch up damaged factory-painted surfaces with original paint color.
 - 4. Protect machine-finish surfaces against corrosion.
- D. Paint machine room and pit floors.

5.3. FIELD QUALITY CONTROL

- A. Work at jobsite will be checked during course of installation. Full cooperation with reviewing personnel is mandatory. Accomplish corrective work required prior to performing further installation.
- B. Perform complete "Acceptance" level pre-testing as specified in the latest edition of ASME A17.2 "Guide for Inspection of Elevators, Escalators, and Moving Walks" prior to AHJ witnessed acceptance testing. Complete any adjustments, repairs, or replacements necessary to achieve code compliant operation including but not limited to:
 - 1. Car emergency communications. Inform Owner and Consultant of any noted failures of Owner provided and maintained equipment or systems.
 - 2. Phase I and II Firefighters' Emergency Operation. Phase I initiated by smoke sensing devices.
 - 3. Power car door operation including door closing force, reopening device, and restricted opening.
- C. Have Code Authority acceptance inspection performed and complete corrective work.
- D. Provide access to installed equipment and elevator personnel assistance for Consultant's final observation and review requirements.

5.4. ADJUSTMENTS

- A. Static balance car to equalize pressure of guide shoes on guide rails.
- B. Verify that weights of existing or altered cars, counterweights, and compensation comply with traction machine manufacturers' requirements and do not exceed total weights indicated on approved submittals. See Section 01 30 00, Submittals.
- C. Lubricate all equipment in accordance with Contractor's instructions.
- D. Adjust motors, power conversion units, brakes, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

5.5. CLEANUP

- A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials daily.
- B. Elevator hoistways and all equipment therein shall be cleaned and left free of rust, filings, welding slag, rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt, and dust, including walls, building beams, sill ledges, and hoistway divider beams.
- C. Care shall be to not to mark, soil, or otherwise deface existing or new surfaces. Clean and restore such surfaces to their original condition.
- D. Clean down surfaces and areas which require final painting and finishing work. Cleaning includes removal of rubbish, broom cleaning of floors, removal of any loose plaster or mortar, dust, and other extraneous materials from finish surfaces, and surfaces which will remain visible after the work is complete.
- E. Paint pit floor and equipment.
- F. Paint machine room walls and floors.
- G. Remove all loose materials and filings resulting from work.
- H. Clean machine room equipment and floor.
- I. Clean car, car enclosure, entrances, operating and signal fixtures.

5.6. FINAL COMPLIANCE REVIEW

- A. Review procedure shall apply for individual elevators, portions of groups of elevators, and completed groups of elevators accepted on an interim basis, or elevators and groups of elevators completed, accepted, and placed in operation.
- B. Contractor shall perform review and evaluation of all aspects of its work prior to requesting Consultant's final review. Work shall be considered ready for Consultant's final contract compliance review when all Contractor's tests are complete, all deficiencies noted by the AHJ have been rectified, and all elements of work or a designated portion thereof are in place and elevator is deemed ready for service as intended.
- C. Provide eight (8) hours of accrued run-in time prior to inspection and field reviews.
 - 1. Run-in time must include door open and close cycles, without interfering with usual business activity.
- D. Contractor shall perform review and evaluation of all aspects of its work prior to requesting consultant's review.
- E. Furnish labor, materials, and equipment necessary for Consultant's review. Notify Consultant five working days in advance when ready for final review of elevator or group of elevators.
- F. Consultant's written list of observed deficiencies of materials, equipment, and operating systems will be submitted to Contractor for corrective action. Consultant's review shall include as a minimum:
 - 1. Workmanship and equipment compliance with Contract Documents.
 - 2. Contract speed, capacity, floor-to-floor times, and door performance compliance with Contract Documents.
 - 3. Performance of following is satisfactory:
 - a) Starting, accelerating, running.
 - b) Decelerating, stopping accuracy.
 - c) Door operation and closing force.
 - d) Equipment noise levels.
 - e) Signal fixture utility.
 - f) Overall ride quality.
 - g) Performance of door control devices.
 - h) Operations of emergency two-way communication device.
 - i) Operations of firefighters' service.
 - j) Operations of special security features and floor lock-off provisions.
 - k) Operations of remote monitoring devices.
 - l) Operations of emergency brake device.
- G. Test Results:
 - 1. In all test conditions, obtain specified contract speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of Owner and Consultant. Tests will be conducted under both no load and full load condition.

END OF SECTION

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Supports and anchorages.
11. Pipe curbs and equipment supports

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

C. Operation and Maintenance Data: At the end of the project the contractor shall submit two paper copies of the Operation and Maintenance Data to the owner in three ring binders with the project title and contractor's contact information.

D. Project Record Documents: Throughout the project the contractor shall keep a running record of as-builts showing deviations from the plans. At the end of the project the contractor shall submit one clean hand sketch set of documents to the owner.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."
- D. Drawings are diagrammatical and do not necessarily show all fittings required to meet field conditions and coordination requirements with other trades. The contractor is responsible for making adjustments in the routing and elevations to meet the job requirements and maintaining required slopes as required for each system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 1. Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 1. Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 1. Manufacturers:
 - a. Capitol Manufacturing Co.

- b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150 or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic, Carbon steel or Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 PIPE CURBS AND EQUIPMENT CURBS

- A. Manufacturers:
 - 1. Pate.
 - 2. RPS Corporation.
 - 3. Thy Curb, Thybar Corporation.
- B. Equipment Support Rails:
 - 1. 18 Gauge galvanized steel with integral base plate, continuous welded corner seams, pressure treated wood nailer, counter flashing with leg screws, and internally reinforced for load bearing requirements.
 - 2. Height: Minimum 18 inches high or as specified.
 - 3. Length: As required for equipment and to span structural supports.
- C. Pipe Curb Assemblies:

1. Heavy Gauge galvanized steel with unitized construction and integral base plate, 3 lb density insulation and 2x2 nailer. Furnish acrylic clad thermo plastic cover, fastening screws, & graduated step boots with stainless steel clamps.
2. Height: 18 inches
3. Multiple Pipes: Size and configure cover to accommodate all pipes serving equipment including power conduit and control conduit.

D. Pipe Seals for Single Roof Penetrations:

1. One piece spun aluminum base with 5 inch flange, polyvinyl chloride boot with graduated widths and adjustable stainless steel clamps.
2. Reference Product: Pate-Pipe Seal.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated or rough-brass finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated or rough-brass finish.
 - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.

- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Install equipment per the manufacturer's recommendations. If the manufacturer's recommendations are different than shown on the construction documents or as otherwise specified contact the engineer.
- F. Contractor shall provide all equipment and associated controls required to provide a complete and operable system.
- G. The scope of work for all Division 22 sections includes all miscellaneous work needed (whether or not specified or shown on the documents) to produce a complete and fully operational system.

3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes mechanical insulation for water heater breeching, equipment and pipe, including the following:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Lagging adhesives.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Tapes.
 - 8. Securements.

1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Field application for each equipment type.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. National Commercial and Industrial Insulation Standards: Comply with installation requirements and standards.
- D. ASHRAE Standard 90.1-2004: Comply with insulation values required by the standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000 (Pipe Insulation).
- d. Manson Insulation Inc.; Alley-K.
- e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 BTU x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

- a. CertainTeed Corp.; Crimp Wrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products:

- a. Aeroflex USA Inc.; Aeroseal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.

- e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-30.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
 - c. ITW TACC, Division of Illinois Tool Works; CB-25.
 - d. Marathon Industries, Inc.; 501.
 - e. Mon-Eco Industries, Inc.; 55-10.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 3. Service Temperature Range: 0 to 180 deg F.
 - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:

- a. Childers Products, Division of ITW; Encacel.
- b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
- c. Marathon Industries, Inc.; 570.
- d. Mon-Eco Industries, Inc.; 55-70.

- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
- 3. Service Temperature Range: Minus 50 to plus 220 deg F.
- 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
- 5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- f. Vimasco Corporation; WC-1/WC-5.

- 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 200 deg F.
- 4. Solids Content: 63 percent by volume and 73 percent by weight.
- 5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

- a. Childers Products, Division of ITW; CP-52.
- b. Foster Products Corporation, H. B. Fuller Company; 81-42.
- c. Marathon Industries, Inc.; 130.
- d. Mon-Eco Industries, Inc.; 11-30.
- e. Vimasco Corporation; 136.

- 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
- 3. Service Temperature Range: Minus 50 to plus 180 deg F.
- 4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Vimasco Corporation; 750.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Materials shall be compatible with insulation materials, jackets, and substrates.
- c. Fire- and water-resistant, flexible, elastomeric sealant.
- d. Service Temperature Range: Minus 40 to plus 250 deg F.
- e. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.
- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/ inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

A. Bands:

1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1½-inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2½-inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - 4) Baseplate: Galvanized carbon-steel sheet, 0.030-inch thick by 2-inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

- c. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal ¾-inch wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers:
 - a. ACS Industries, Inc.
 - b. C & F Wire.
 - c. Childers Products.
 - d. PABCO Metals Corporation.
 - e. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation products in strict accordance with manufacturer's installation instructions and the National Commercial and Industrial Insulation Standards.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1½-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **[2 inches] [4 inches]** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):
Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Firestopping and fire-resistive joint sealers are specified in other Divisions.
- C. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies according to other Divisions.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Sanitary Piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be any of the following:
 - a. Pre-formed Fiber with ASJ Jacket: 1inch thick.
 - b. Flexible Elastomeric: 1-inch thick.

END OF SECTION 220700

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes mechanical insulation for water heater breeching, equipment and pipe, including the following:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Lagging adhesives.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Tapes.
 - 8. Securements.

1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Field application for each equipment type.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. National Commercial and Industrial Insulation Standards: Comply with installation requirements and standards.
- D. ASHRAE Standard 90.1-2004: Comply with insulation values required by the standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000 (Pipe Insulation).
- d. Manson Insulation Inc.; Alley-K.
- e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 BTU x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

- a. CertainTeed Corp.; Crimp Wrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products:

- a. Aeroflex USA Inc.; Aeroseal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.

- e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-30.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
 - c. ITW TACC, Division of Illinois Tool Works; CB-25.
 - d. Marathon Industries, Inc.; 501.
 - e. Mon-Eco Industries, Inc.; 55-10.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 3. Service Temperature Range: 0 to 180 deg F.
 - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:

- a. Childers Products, Division of ITW; Encacel.
- b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
- c. Marathon Industries, Inc.; 570.
- d. Mon-Eco Industries, Inc.; 55-70.

- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
- 3. Service Temperature Range: Minus 50 to plus 220 deg F.
- 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
- 5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- f. Vimasco Corporation; WC-1/WC-5.

- 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 200 deg F.
- 4. Solids Content: 63 percent by volume and 73 percent by weight.
- 5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

- a. Childers Products, Division of ITW; CP-52.
- b. Foster Products Corporation, H. B. Fuller Company; 81-42.
- c. Marathon Industries, Inc.; 130.
- d. Mon-Eco Industries, Inc.; 11-30.
- e. Vimasco Corporation; 136.

- 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
- 3. Service Temperature Range: Minus 50 to plus 180 deg F.
- 4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Vimasco Corporation; 750.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Materials shall be compatible with insulation materials, jackets, and substrates.
- c. Fire- and water-resistant, flexible, elastomeric sealant.
- d. Service Temperature Range: Minus 40 to plus 250 deg F.
- e. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.
- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/ inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

A. Bands:

1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1½-inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2½-inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - 4) Baseplate: Galvanized carbon-steel sheet, 0.030-inch thick by 2-inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

- c. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal ¾-inch wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers:
 - a. ACS Industries, Inc.
 - b. C & F Wire.
 - c. Childers Products.
 - d. PABCO Metals Corporation.
 - e. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation products in strict accordance with manufacturer's installation instructions and the National Commercial and Industrial Insulation Standards.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1½-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **[2 inches] [4 inches]** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):
Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Firestopping and fire-resistive joint sealers are specified in other Divisions.
- C. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies according to other Divisions.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Sanitary Piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be any of the following:
 - a. Pre-formed Fiber with ASJ Jacket: 1inch thick.
 - b. Flexible Elastomeric: 1-inch thick.

END OF SECTION 220700

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes mechanical insulation for water heater breeching, equipment and pipe, including the following:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Lagging adhesives.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Tapes.
 - 8. Securements.

1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Field application for each equipment type.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. National Commercial and Industrial Insulation Standards: Comply with installation requirements and standards.
- D. ASHRAE Standard 90.1-2004: Comply with insulation values required by the standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000 (Pipe Insulation).
- d. Manson Insulation Inc.; Alley-K.
- e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 BTU x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

- a. CertainTeed Corp.; Crimp Wrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products:

- a. Aeroflex USA Inc.; Aeroseal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.

- e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-30.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
 - c. ITW TACC, Division of Illinois Tool Works; CB-25.
 - d. Marathon Industries, Inc.; 501.
 - e. Mon-Eco Industries, Inc.; 55-10.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 3. Service Temperature Range: 0 to 180 deg F.
 - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:

- a. Childers Products, Division of ITW; Encacel.
- b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
- c. Marathon Industries, Inc.; 570.
- d. Mon-Eco Industries, Inc.; 55-70.

- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
- 3. Service Temperature Range: Minus 50 to plus 220 deg F.
- 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
- 5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- f. Vimasco Corporation; WC-1/WC-5.

- 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 200 deg F.
- 4. Solids Content: 63 percent by volume and 73 percent by weight.
- 5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

- a. Childers Products, Division of ITW; CP-52.
- b. Foster Products Corporation, H. B. Fuller Company; 81-42.
- c. Marathon Industries, Inc.; 130.
- d. Mon-Eco Industries, Inc.; 11-30.
- e. Vimasco Corporation; 136.

- 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
- 3. Service Temperature Range: Minus 50 to plus 180 deg F.
- 4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Vimasco Corporation; 750.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Materials shall be compatible with insulation materials, jackets, and substrates.
- c. Fire- and water-resistant, flexible, elastomeric sealant.
- d. Service Temperature Range: Minus 40 to plus 250 deg F.
- e. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.
- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/ inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

A. Bands:

1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1½-inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2½-inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - 4) Baseplate: Galvanized carbon-steel sheet, 0.030-inch thick by 2-inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

- c. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal ¾-inch wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers:
 - a. ACS Industries, Inc.
 - b. C & F Wire.
 - c. Childers Products.
 - d. PABCO Metals Corporation.
 - e. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation products in strict accordance with manufacturer's installation instructions and the National Commercial and Industrial Insulation Standards.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1½-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **[2 inches] [4 inches]** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Firestopping and fire-resistive joint sealers are specified in other Divisions.
- C. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies according to other Divisions.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Sanitary Piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be any of the following:
 - a. Pre-formed Fiber with ASJ Jacket: 1inch thick.
 - b. Flexible Elastomeric: 1-inch thick.

END OF SECTION 220700

SECTION 221323 - SANITARY WASTE INTERCEPTORS

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. Oil interceptors.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of **plastic** interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
 - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Piping connections. Include size, location, and elevation of each.
 - 2. Interface with underground structures and utility services.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency, operation, and maintenance manuals.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
1. Notify **Owner**]no fewer than **seven** days in advance of proposed interruption of service.
 2. Do not proceed with interruption of sewer services without **Owner's** written permission.

PART 2 - PRODUCTS

2.1 OIL INTERCEPTORS

- A. Manufacturers:
1. Town & Country Plastics
 2. MIFAB
 3. Zurn Proceptor
- B. Plastic Oil Interceptors: Removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
1. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 2. Cover: Plastic **A-03**, walkway load.
 3. Capacities and Characteristics: as scheduled on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install precast concrete interceptors according to ASTM C891.
- B. Set interceptors level and plumb.
- C. Set **plastic** interceptors level and plumb.
- D. Install piping and oil storage tanks according to Section 231113 "Facility Fuel-Oil Piping."
- E. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

3.3 IDENTIFICATION

- A. Identification materials and installation are specified in Section 312000 "Earth Moving."
 - 1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 2. Use warning tapes or detectable warning tape over ferrous piping.
 - 3. Use detectable warning tape over nonferrous piping and over edges of underground structures.
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Oil interceptors.

3.4 PROTECTION

- A. Protect sanitary waste interceptors from damage during construction period.
- B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION 221323

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes mechanical insulation for water heater breeching, equipment and pipe, including the following:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Lagging adhesives.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Tapes.
 - 8. Securements.

1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Field application for each equipment type.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. National Commercial and Industrial Insulation Standards: Comply with installation requirements and standards.
- D. ASHRAE Standard 90.1-2004: Comply with insulation values required by the standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000 (Pipe Insulation).
- d. Manson Insulation Inc.; Alley-K.
- e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 BTU x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

- a. CertainTeed Corp.; Crimp Wrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products:

- a. Aeroflex USA Inc.; Aeroseal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.

- e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-30.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
 - c. ITW TACC, Division of Illinois Tool Works; CB-25.
 - d. Marathon Industries, Inc.; 501.
 - e. Mon-Eco Industries, Inc.; 55-10.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 3. Service Temperature Range: 0 to 180 deg F.
 - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:

- a. Childers Products, Division of ITW; Encacel.
- b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
- c. Marathon Industries, Inc.; 570.
- d. Mon-Eco Industries, Inc.; 55-70.

- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
- 3. Service Temperature Range: Minus 50 to plus 220 deg F.
- 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
- 5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- f. Vimasco Corporation; WC-1/WC-5.

- 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 200 deg F.
- 4. Solids Content: 63 percent by volume and 73 percent by weight.
- 5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

- a. Childers Products, Division of ITW; CP-52.
- b. Foster Products Corporation, H. B. Fuller Company; 81-42.
- c. Marathon Industries, Inc.; 130.
- d. Mon-Eco Industries, Inc.; 11-30.
- e. Vimasco Corporation; 136.

- 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
- 3. Service Temperature Range: Minus 50 to plus 180 deg F.
- 4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Vimasco Corporation; 750.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

- a. Childers Products, Division of ITW; CP-76.
- b. Materials shall be compatible with insulation materials, jackets, and substrates.
- c. Fire- and water-resistant, flexible, elastomeric sealant.
- d. Service Temperature Range: Minus 40 to plus 250 deg F.
- e. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.
- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/ inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

A. Bands:

1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1½-inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2½-inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - 4) Baseplate: Galvanized carbon-steel sheet, 0.030-inch thick by 2-inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

- c. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.
 - a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal ¾-inch wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers:
 - a. ACS Industries, Inc.
 - b. C & F Wire.
 - c. Childers Products.
 - d. PABCO Metals Corporation.
 - e. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation products in strict accordance with manufacturer's installation instructions and the National Commercial and Industrial Insulation Standards.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1½-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **[2 inches] [4 inches]** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):
Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Firestopping and fire-resistive joint sealers are specified in other Divisions.
- C. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies according to other Divisions.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Sanitary Piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be any of the following:
 - a. Pre-formed Fiber with ASJ Jacket: 1inch thick.
 - b. Flexible Elastomeric: 1-inch thick.

END OF SECTION 220700

SECTION 230500 COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Mechanical demolition
 - 6. Sleeves.
 - 7. Escutcheons.
 - 8. Grout.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Supports and anchorages.
 - 12. Pipe curbs and equipment supports.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

C. Operation and Maintenance Data: At the end of the project the contractor shall submit two paper copies of the Operation and Maintenance Data to the owner in three ring binders with the project title and contractor's contact information.

D. Project Record Documents: Throughout the project the contractor shall keep a running record of as-builts showing deviations from the plans. At the end of the project the contractor shall submit one clean hand sketch set of documents to the owner.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. Install all equipment, materials, and accessories per manufacturers written instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Underground Piping NPS 1½ and Smaller: Manufactured fitting or coupling.
 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 1. Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300-psig minimum working pressure as required to suit system pressures.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Separate companion flanges and steel bolts and nuts shall have 150 or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:

- a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic, Carbon steel or Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.10 PIPE CURBS AND EQUIPMENT CURBS

- A. Manufacturers:
 1. Pate.
 2. RPS Corporation.
 3. Thy Curb, Thybar Corporation.
- B. Equipment Support Rails:
 1. 18 Gauge galvanized steel with integral base plate, continuous welded corner seams, pressure treated wood nailer, counter flashing with leg screws, and internally reinforced for load bearing requirements.
 2. Height: Minimum 18 inches high or as specified.
 3. Length: As required for equipment and to span structural supports.
- C. Pipe Curb Assemblies:
 1. Heavy Gauge galvanized steel with unitized construction and integral base plate, 3 lb density insulation and 2x2 nailer. Furnish acrylic clad thermo plastic cover, fastening screws, & graduated step boots with stainless steel clamps.
 2. Height: 18 inches
 3. Multiple Pipes: Size and configure cover to accommodate all pipes serving equipment including power conduit and control conduit.
- D. Pipe Seals for Single Roof Penetrations:

1. One piece spun aluminum base with 5 inch flange, polyvinyl chloride boot with graduated widths and adjustable stainless steel clamps.
2. Reference Product: Pate-Pipe Seal.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated or rough-brass finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.

- b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated or rough-brass finish.
 - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
- 1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.3 PIPING JOINT CONSTRUCTION
- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
 - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 - E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric nipple fittings to connect piping materials of dissimilar metals.
 - a. For piping systems operating below ambient temperature, provide dielectric nipple and brass ball valve or dielectric coupling to separate interior and exterior dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Install equipment per the manufacturer's recommendations. If the manufacturer's recommendations are different than shown on the construction documents or as otherwise specified contact the engineer.
- F. Contractor shall provide all equipment and associated controls required to provide a complete and operable system.
- G. The scope of work for all Division 23 sections includes all miscellaneous work needed (whether or not specified or shown on the documents) to produce a complete and fully operational system.

3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Architectural Section.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.9 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

END OF SECTION 230500

SECTION 230523 GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy butterfly valves.
 - 3. Copper-alloy Butterfly Valves
 - 4. Ferrous-alloy check valves
 - 5. Bronze check valves.
 - 6. Gate valves.
- B. See other piping Sections for general-duty and specialty valves for site construction piping.
- C. See Division 23 Section "HVAC Instrumentation and Controls for HVAC" for control valves and actuators.
- D. See Division 23 piping Sections for specialty valves applicable to those Sections only.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and Smaller: Threaded ends, unless otherwise indicated.
- C. Brass Valves: NPS 2 and Smaller: Victaulic VIP Press 304™ ends, unless otherwise indicated
- D. Ferrous Valves NPS 2-1/2 and Larger: Grooved or flanged ends, unless otherwise indicated.
- E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
- H. Extended Valve Stems: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: ASME/AWWA C606.
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F for check, gate, and globe valves; below 421 deg F for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.
- K. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. One-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Jenkins Valves.
 - c. Stockham Valves.
 - d. Grinnell Corporation.
 - e. Jamesbury, Inc.
 - f. NIBCO INC.
 - g. Watts Industries, Inc.; Water Products Div.

2. Two-Piece, Copper-Alloy Ball Valves:

- a. Conbraco Industries, Inc.; Apollo Div.
- b. Crane Valves.
- c. Jenkins Valves.
- d. Stockham Valves.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Jamesbury, Inc.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Victaulic Company of America
- k. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

- 1. Ball Valves – 2” and Smaller (Alternate to standard port): Ball valves shall be 300 or 600# WOG, 150# SWP, 2 piece body style, full port, CP solid brass tunneled ball, reinforced Teflon seats, hex gland follower, bronze body of ASTM B584, blowout proof stem, lever handle.
- 2. Ball valves shall be 400-psig CWP, 3 piece body style, full port, stainless steel ball and stem. PTFE seats, stainless steel body of ASTM A351, grade CF8M, blowout proof stem, lever handle. Basis of design: Victaulic Series P569.
- 3. Ball Valves – 3” and Smaller: Ball valves shall be 300 or 600# WOG, 150# SWP, 2 piece body style, STD port, CP solid brass tunneled ball, reinforced Teflon seats, hex gland follower, bronze body of ASTM B584, blowout proof stem, lever handle.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

- a. Ferrous-Alloy Butterfly Valves:
- b. Crane Co.; Crane Valve Group; Center Line.
- c. Stockham Valves.
- d. Grinnell Corporation.
- e. Hammond Valve.
- f. Metraflex Co.
- g. Milwaukee Valve Company.
- h. Mueller Steam Specialty.
- i. NIBCO INC.
- j. Tyco International, Ltd.; Tyco Valves & Controls.
- k. Victaulic Company of America
- l. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

- 1. Butterfly Valves – 3” & Larger: Butterfly valves shall be 200# WOG, full lug body of ASTM A126 Class B cast iron, aluminum bronze disc, 416 stainless steel stems, 2 piece

stem design, field replaceable hard phenolic backed EPDM liner, non-metallic. stem journal, blow-out proof stem, extended neck, MSS SP-67

2. Butterfly Valves, Grooved-End: 300 psig CWP rating, ferrous alloy, ductile iron body with grooved or shouldered ends in accordance with ASME/AWWA C606. Valve seat shall be pressure responsive in sizes through 12", and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Basis of design: Victaulic Vic300 Masterseal and AGS-Vic300.

2.5 NON-FERROUS ALLOY BUTTERFLY VALVES

A. Manufacturer:

1. Victaulic Company.

- B. Butterfly Valves, Grooved-end: 300 psig CWP rating, non-ferrous alloy, cast-brass body with copper-tube dimensioned grooved ends. Valve seat shall be pressure responsive, and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.

1. Basis of design: Victaulic Series 608N.

2.6 FERROUS-ALLOY CHECK VALVES

A. Manufacturer:

1. Victaulic Company.

- B. Hydronic Water Only – Grooved end spring-assisted swing check for vertical or horizontal installation: 230 or 300 psig CWP rating, stainless steel spring and shaft, with ductile iron body and grooved ends.

1. Basis of Design: Victaulic Series 716 (300-psig) and AGS Series W715 (230-psig).

2.7 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Stockham Div.

2. Bronze, Swing Check Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.

- f. Hammond Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell, Wm. Co.
- j. Victaulic Company of America (Hydronic water systems)
- k. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Check Valves – Up To 2½”: Check valves shall be class 150# SWP, 300# WOG, horizontal swing check, body and cap shall be of ASTM B62 cast bronze, TFE disc, integral bronze seats, MSS SP-80
2. Check Valves – 3” and Larger: Check valves shall be class 125# SWP, 200# WOG, horizontal swing check, body and cap shall be of ASTM A 126 cast iron, bronze trim, bolted cap, flanged ends, MSS SP-71
3. (Hydronic only) Silent Check Valves – 2 1/2” and Larger: Silent check valves shall be 200# WOG minimum, body shall be of ASTM A126 class B cast iron, center guided, SS spring and screws, bronze disc, bronze seat.
4. Hydronic Only – Grooved end swing check: 175 or 300psig CWP rating Ductile Iron body with grooved or shouldered ends, ASME/AWWA C606.

2.8 GATE VALVES

A. Manufacturers:

1. Gate Valves:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell, Wm. Co.
- j. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Gate Valves – Up To 2 ½”: Gate valves shall be class 150# SWP, 300# WOG, rising stem, union bonnet, solid wedge malleable iron handwheel, body, bonnet, and union nut shall be of ASTM B62 Bronze, non-asbestos packing, MSS SP-80.
2. Gate Valves – 3” and larger: Gate valves shall be class 125# SWP, 200# WOG, rising stem, OS&Y, bolted bonnet, body and bonnet shall be of ASTM A126 Class B cast iron, flange ends, bronze trim, non-asbestos packing, MSS SP-70.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Throttling Service: Ball, butterfly, or globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.2 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Unions and flanges for servicing and disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall service as disconnect points if required.)
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow full stem movement.
- G. Provide stem extensions for ball valves being installed on insulated lines.
- H. Provide memory stops for all valves to be used for balancing.
- I. Install butterfly valves with stem at the horizontal, and so that the handle points down when closed, and in the direction of flow when in the open position.
- J. Adjust all packing nuts after installation.
- K. Provide lever handles for 6" and smaller butterfly valves.
- L. Provide gear operator for 8" and larger butterfly valves.

3.3 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Access panel and door markers.
4. Pipe markers.
5. Duct markers.
6. Valve tags.
7. Valve schedules.
8. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

- B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick brass or aluminum.
2. Material: 3/32-inch-thick laminated plastic with 2 black surfaces and white inner layer.
3. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.5 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Finished hardwood or Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 2. Fans, blowers and air terminals.
 - 3. Air handling units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2. Data: Distinguish among multiple units,
 - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Air handling units, air terminals, and fan coil units.
 - e. Tanks and pressure vessels.
 - f. Humidifiers, water-treatment systems, and similar equipment.

- C. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
1. Green: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

- a. 2 inches, round

2. Valve-Tag Color:

- a. Brass or aluminum

3.6 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.
- B. Provide warning tags on equipment and with wording as directed by the Architect.

3.8 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Access panel and door markers.
4. Pipe markers.
5. Duct markers.
6. Valve tags.
7. Valve schedules.
8. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

- B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick brass or aluminum.
2. Material: 3/32-inch-thick laminated plastic with 2 black surfaces and white inner layer.
3. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.5 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Finished hardwood or Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 2. Fans, blowers and air terminals.
 - 3. Air handling units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2. Data: Distinguish among multiple units,
 - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Air handling units, air terminals, and fan coil units.
 - e. Tanks and pressure vessels.
 - f. Humidifiers, water-treatment systems, and similar equipment.

- C. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
1. Green: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

- a. 2 inches, round

2. Valve-Tag Color:

- a. Brass or aluminum

3.6 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.
- B. Provide warning tags on equipment and with wording as directed by the Architect.

3.8 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553

SECTION 230523 GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy butterfly valves.
 - 3. Copper-alloy Butterfly Valves
 - 4. Ferrous-alloy check valves
 - 5. Bronze check valves.
 - 6. Gate valves.
- B. See other piping Sections for general-duty and specialty valves for site construction piping.
- C. See Division 23 Section "HVAC Instrumentation and Controls for HVAC" for control valves and actuators.
- D. See Division 23 piping Sections for specialty valves applicable to those Sections only.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and Smaller: Threaded ends, unless otherwise indicated.
- C. Brass Valves: NPS 2 and Smaller: Victaulic VIP Press 304™ ends, unless otherwise indicated
- D. Ferrous Valves NPS 2-1/2 and Larger: Grooved or flanged ends, unless otherwise indicated.
- E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
- H. Extended Valve Stems: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: ASME/AWWA C606.
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F for check, gate, and globe valves; below 421 deg F for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.
- K. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. One-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Jenkins Valves.
 - c. Stockham Valves.
 - d. Grinnell Corporation.
 - e. Jamesbury, Inc.
 - f. NIBCO INC.
 - g. Watts Industries, Inc.; Water Products Div.

2. Two-Piece, Copper-Alloy Ball Valves:

- a. Conbraco Industries, Inc.; Apollo Div.
- b. Crane Valves.
- c. Jenkins Valves.
- d. Stockham Valves.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Jamesbury, Inc.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Victaulic Company of America
- k. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Ball Valves – 2” and Smaller (Alternate to standard port): Ball valves shall be 300 or 600# WOG, 150# SWP, 2 piece body style, full port, CP solid brass tunneled ball, reinforced Teflon seats, hex gland follower, bronze body of ASTM B584, blowout proof stem, lever handle.
2. Ball valves shall be 400-psig CWP, 3 piece body style, full port, stainless steel ball and stem. PTFE seats, stainless steel body of ASTM A351, grade CF8M, blowout proof stem, lever handle. Basis of design: Victaulic Series P569.
3. Ball Valves – 3” and Smaller: Ball valves shall be 300 or 600# WOG, 150# SWP, 2 piece body style, STD port, CP solid brass tunneled ball, reinforced Teflon seats, hex gland follower, bronze body of ASTM B584, blowout proof stem, lever handle.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

- a. Ferrous-Alloy Butterfly Valves:
- b. Crane Co.; Crane Valve Group; Center Line.
- c. Stockham Valves.
- d. Grinnell Corporation.
- e. Hammond Valve.
- f. Metraflex Co.
- g. Milwaukee Valve Company.
- h. Mueller Steam Specialty.
- i. NIBCO INC.
- j. Tyco International, Ltd.; Tyco Valves & Controls.
- k. Victaulic Company of America
- l. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Butterfly Valves – 3” & Larger: Butterfly valves shall be 200# WOG, full lug body of ASTM A126 Class B cast iron, aluminum bronze disc, 416 stainless steel stems, 2 piece

stem design, field replaceable hard phenolic backed EPDM liner, non-metallic. stem journal, blow-out proof stem, extended neck, MSS SP-67

2. Butterfly Valves, Grooved-End: 300 psig CWP rating, ferrous alloy, ductile iron body with grooved or shouldered ends in accordance with ASME/AWWA C606. Valve seat shall be pressure responsive in sizes through 12", and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Basis of design: Victaulic Vic300 Masterseal and AGS-Vic300.

2.5 NON-FERROUS ALLOY BUTTERFLY VALVES

A. Manufacturer:

1. Victaulic Company.

- B. Butterfly Valves, Grooved-end: 300 psig CWP rating, non-ferrous alloy, cast-brass body with copper-tube dimensioned grooved ends. Valve seat shall be pressure responsive, and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.

1. Basis of design: Victaulic Series 608N.

2.6 FERROUS-ALLOY CHECK VALVES

A. Manufacturer:

1. Victaulic Company.

- B. Hydronic Water Only – Grooved end spring-assisted swing check for vertical or horizontal installation: 230 or 300 psig CWP rating, stainless steel spring and shaft, with ductile iron body and grooved ends.

1. Basis of Design: Victaulic Series 716 (300-psig) and AGS Series W715 (230-psig).

2.7 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Stockham Div.

2. Bronze, Swing Check Valves with Metal Disc:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.

- f. Hammond Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell, Wm. Co.
- j. Victaulic Company of America (Hydronic water systems)
- k. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Check Valves – Up To 2½”: Check valves shall be class 150# SWP, 300# WOG, horizontal swing check, body and cap shall be of ASTM B62 cast bronze, TFE disc, integral bronze seats, MSS SP-80
2. Check Valves – 3” and Larger: Check valves shall be class 125# SWP, 200# WOG, horizontal swing check, body and cap shall be of ASTM A 126 cast iron, bronze trim, bolted cap, flanged ends, MSS SP-71
3. (Hydronic only) Silent Check Valves – 2 1/2” and Larger: Silent check valves shall be 200# WOG minimum, body shall be of ASTM A126 class B cast iron, center guided, SS spring and screws, bronze disc, bronze seat.
4. Hydronic Only – Grooved end swing check: 175 or 300psig CWP rating Ductile Iron body with grooved or shouldered ends, ASME/AWWA C606.

2.8 GATE VALVES

A. Manufacturers:

1. Gate Valves:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell, Wm. Co.
- j. Watts Industries, Inc.; Water Products Div.

B. Hydronic:

1. Gate Valves – Up To 2 ½”: Gate valves shall be class 150# SWP, 300# WOG, rising stem, union bonnet, solid wedge malleable iron handwheel, body, bonnet, and union nut shall be of ASTM B62 Bronze, non-asbestos packing, MSS SP-80.
2. Gate Valves – 3” and larger: Gate valves shall be class 125# SWP, 200# WOG, rising stem, OS&Y, bolted bonnet, body and bonnet shall be of ASTM A126 Class B cast iron, flange ends, bronze trim, non-asbestos packing, MSS SP-70.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Throttling Service: Ball, butterfly, or globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.2 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Unions and flanges for servicing and disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall service as disconnect points if required.)
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow full stem movement.
- G. Provide stem extensions for ball valves being installed on insulated lines.
- H. Provide memory stops for all valves to be used for balancing.
- I. Install butterfly valves with stem at the horizontal, and so that the handle points down when closed, and in the direction of flow when in the open position.
- J. Adjust all packing nuts after installation.
- K. Provide lever handles for 6" and smaller butterfly valves.
- L. Provide gear operator for 8" and larger butterfly valves.

3.3 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 232300 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-454A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Hot-Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
 - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Equipment manufacturer's authorized representative shall review and approve refrigerant piping before installation.

- C. Welding certificates.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L or ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 6. Working Pressure Rating: 400 psig.
 7. Maximum Operating Temperature: 240 deg F.
 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Working Pressure Rating: 400 psig.
 6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 deg F.
 6. Superheat: Adjustable.
 7. Reverse-flow option (for heat-pump applications).
 8. End Connections: Socket, flare, or threaded union.
 9. Working Pressure Rating: 700 psig.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: External.
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 8. End Connections: Socket.
 9. Throttling Range: Maximum 5 psig.
 10. Working Pressure Rating: 500 psig.
 11. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig.
 5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-454A: low GWP hydrofluoro-olefin (HFO) based refrigerant.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR or L, drawn-temper tubing and wrought-copper fittings with soldered joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- G. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.

2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 50 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 50 feet or longer for pipes 1½-inches or larger.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 1. Open shutoff valves in condenser water circuit.
 2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.
 4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 2300

SECTION 232300 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-454A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Hot-Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
 - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Equipment manufacturer's authorized representative shall review and approve refrigerant piping before installation.

- C. Welding certificates.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L or ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 6. Working Pressure Rating: 400 psig.
 7. Maximum Operating Temperature: 240 deg F.
 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Working Pressure Rating: 400 psig.
 6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 deg F.
 6. Superheat: Adjustable.
 7. Reverse-flow option (for heat-pump applications).
 8. End Connections: Socket, flare, or threaded union.
 9. Working Pressure Rating: 700 psig.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: External.
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 8. End Connections: Socket.
 9. Throttling Range: Maximum 5 psig.
 10. Working Pressure Rating: 500 psig.
 11. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig.
 5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-454A: low GWP hydrofluoro-olefin (HFO) based refrigerant.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR or L, drawn-temper tubing and wrought-copper fittings with soldered joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- G. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.

2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 50 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 50 feet or longer for pipes 1½-inches or larger.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 1. Open shutoff valves in condenser water circuit.
 2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.
 4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 2300

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at

penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Colors for 240/120-V Three Phase Circuits:

- 1) Phase A: Black.
 - 2) Phase B (Hi leg): Orange.
 - 3) Phase C: Blue.
 - e. Colors for 240/120-V Single Phase Circuits:
 - 1) Phase A: Black.
 - 2) Phase C: Red.
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
 - a. Enclosures and electrical cabinets.
 - b. Access doors and panels for concealed electrical items.
 - c. Enclosed switches.

END OF SECTION 260553

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at

penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Colors for 240/120-V Three Phase Circuits:

- 1) Phase A: Black.
 - 2) Phase B (Hi leg): Orange.
 - 3) Phase C: Blue.
 - e. Colors for 240/120-V Single Phase Circuits:
 - 1) Phase A: Black.
 - 2) Phase C: Red.
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
 - a. Enclosures and electrical cabinets.
 - b. Access doors and panels for concealed electrical items.
 - c. Enclosed switches.

END OF SECTION 260553

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at

penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Colors for 240/120-V Three Phase Circuits:

- 1) Phase A: Black.
 - 2) Phase B (Hi leg): Orange.
 - 3) Phase C: Blue.
 - e. Colors for 240/120-V Single Phase Circuits:
 - 1) Phase A: Black.
 - 2) Phase C: Red.
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
 - a. Enclosures and electrical cabinets.
 - b. Access doors and panels for concealed electrical items.
 - c. Enclosed switches.

END OF SECTION 260553

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 QUALITY ASSURANCE

- 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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 UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Flexible raceway runs.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 2. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 3. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.
 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

- C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
1. Include data on features, accessories, and finishes.
 2. Include physical description of the unit and dimensions.
 3. Battery and charger for light units.
 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each luminaire for tests performed by contractor.
- B. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 1. Warranty Period for Emergency Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1400 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet.
 - 4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.2 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Refer to lighting fixture schedule on drawings.

2.3 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Clear glass, Prismatic acrylic or Clear, UV-stabilized acrylic.
 - 2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded aluminum housing and heat sink.
 - 2. Clear anodized finish.
- E. Conduit: Flexible metallic conduit, minimum 3/4 inch in diameter.

2.4 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- E. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.

2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

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

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Perform startup service:
 1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
 2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
 1. Inspect all luminaires. Replace lamps, emergency power units , batteries, signs, or luminaires that are defective.
 - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 QUALITY ASSURANCE

- 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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 UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Flexible raceway runs.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at

penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Colors for 240/120-V Three Phase Circuits:

- 1) Phase A: Black.
 - 2) Phase B (Hi leg): Orange.
 - 3) Phase C: Blue.
 - e. Colors for 240/120-V Single Phase Circuits:
 - 1) Phase A: Black.
 - 2) Phase C: Red.
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
 - a. Enclosures and electrical cabinets.
 - b. Access doors and panels for concealed electrical items.
 - c. Enclosed switches.

END OF SECTION 260553

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at

penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Colors for 240/120-V Three Phase Circuits:

- 1) Phase A: Black.
 - 2) Phase B (Hi leg): Orange.
 - 3) Phase C: Blue.
 - e. Colors for 240/120-V Single Phase Circuits:
 - 1) Phase A: Black.
 - 2) Phase C: Red.
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
 - a. Enclosures and electrical cabinets.
 - b. Access doors and panels for concealed electrical items.
 - c. Enclosed switches.

END OF SECTION 260553

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches, switchboards, controllers and motor-control centers.

1.2 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.4 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than three of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK5, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Enclosures.

1.2 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.
- E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Available Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D/Group Schneider.
- B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.2 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
 - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 265119 - LED INTERIOR LIGHTING

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. Linear industrial.
 - 2. Materials.
 - 3. Luminaire support.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests[, **complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this**

- a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
 1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. **Use same designations indicated on Drawings.**

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Luminaires.
 2. Structural members to which luminaires will be attached.
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.
 3. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.

- E. Product Test Reports: For each type of luminaire, for tests performed by **a qualified testing agency**.
- F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:
 - 1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
 - 2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- B. Warranty Period: **Five**year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: **41 to 104 deg F (5 to 40 deg C)**].

1. Relative Humidity: Zero to 95 percent.

- B. Altitude: Sea level to **1000 feet (300 m)**.

2.2 LUMINAIRE 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

- a. "USE ONLY" and include specific lamp type.
- b. Lamp diameter, shape, size, wattage, and coating.
- c. CCT and CRI.

- C. Recessed luminaires shall comply with NEMA LE 4.

- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

- F. California Title 24 compliant.

2.3 LINEAR INDUSTRIAL Typed 'LA', 'LB'

- A. Manufacturers:

- 1. Lithonia
- 2.

- B. Lamp:

- 1. Minimum 4100 lm.
- 2. Minimum allowable efficacy of **172**> lm/W.

3. CRI of **80**. CCT of **4000 K**.
4. Rated lamp life of **50,000** hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. Lens Thickness: At least **0.080-inch** minimum unless otherwise indicated.

C. Housings:

1. Fiberglass housing.

D. Housing Rating:

1. NEMA 4X.
2. IP 65.
3. IP 66.
4. IP 67

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Injection molded acrylic>.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least **0.080-inch** minimum unless otherwise indicated.

G. With integral mounting provisions.

H. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

- C. Stainless Steel:
 - 1. Manufacturer's standard grade.
 - 2. Manufacturer's standard type, ASTM A240/240M.
- D. Galvanized Steel: ASTM A653/A653M.
- E. Aluminum: ASTM B209.

2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: **1/2-inch (13-mm)** steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.
- D. Rod Hangers: **3/16-inch (5-mm)** minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaires:
 - 1. **Attached to structural members in walls**
 - 2. Do not attach luminaires directly to gypsum board.
- F. Ceiling-Mounted Luminaires:
 - 1. Secure to any required outlet box.
- G. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

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

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
1. Include data on features, accessories, and finishes.
 2. Include physical description of the unit and dimensions.
 3. Battery and charger for light units.
 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each luminaire for tests performed by contractor.
- B. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 1. Warranty Period for Emergency Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1400 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet.
 - 4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.2 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Refer to lighting fixture schedule on drawings.

2.3 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Clear glass, Prismatic acrylic or Clear, UV-stabilized acrylic.
 - 2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded aluminum housing and heat sink.
 - 2. Clear anodized finish.
- E. Conduit: Flexible metallic conduit, minimum 3/4 inch in diameter.

2.4 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- E. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.

2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

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

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

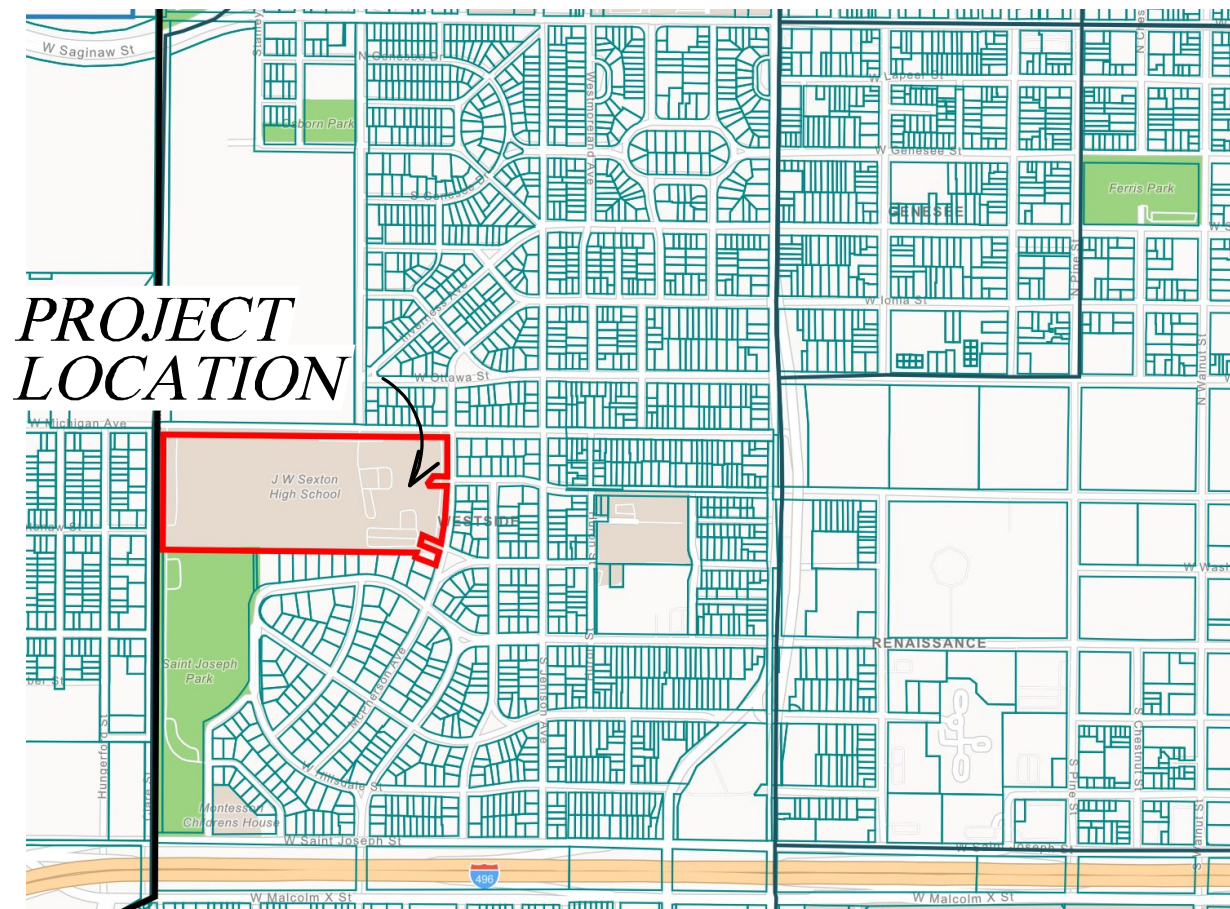
3.5 STARTUP SERVICE

- A. Perform startup service:
 1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
 2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
 1. Inspect all luminaires. Replace lamps, emergency power units , batteries, signs, or luminaires that are defective.
 - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219



State Code Authorities Having Jurisdiction		
Public School Safety	State of Michigan Office of Fire Safety 517-241-6300	School Fire Safety Rules, based on NFPA 101-2012 as amended and effective June 20, 2016.
Building	State of Michigan Construction Codes 517-241-9317	Michigan Building Code 2021, Part 4, based on IBC 2021 adopted as amended and effective April 9, 2025. When Referenced to by the Michigan Rehabilitation Code for Existing Buildings 2021.
Existing Building	State of Michigan Construction Codes 517-241-9317	Michigan Rehabilitation Code for Existing Buildings 2021, based on IBC21 2021 adopted as amended and effective April 9, 2025.
Chapter 5 - Prescriptive Compliance		
Barrier Free	State of Michigan Construction Codes 517-241-9317	Michigan Building Code 2021, Part 4 based on IBC 2021 adopted as amended and effective April 9, 2025, and referencing ICC/ANSI A117.1-2017
Mechanical	State of Michigan Construction Codes 517-241-9325	Michigan Mechanical Code 2021 Part 9A, based on IMC 2021 adopted as amended and effective March 12, 2024.
Plumbing	State of Michigan Construction Codes 517-241-6330	Michigan Plumbing Code 2021 based on IPC 2021 adopted and effective March 12, 2024
Electrical	State of Michigan Construction Codes 517-241-9337	Michigan Electrical Rules, Part 8 based on NEC 2023 adopted as amended and effective March 12, 2024
Energy	State of Michigan Construction Codes 517-241-9337	Michigan Uniform Energy Code Rules, Part 10A; based ASHRAE energy standard for buildings except low-rise residential buildings. ANSI/ASHRAE/IESNA, standard 90.1-2019 including appendices A, B, C, E, F, G, H, and I. With the amendments noted, adopted as effective April 22, 2025.
Elevator	State of Michigan Construction Codes 517-241-9337	State of Michigan Elevator Code effective July 11, 2014, ASME A17.1- 2016 safety code for elevators and escalators ASME A17.6- 2017 standard for elevator suspension, compensation, and governor systems ASME A18.1- 2017 safety code standard for platform lifts and stairway chairlifts
Fire	State of Michigan Office of Fire Safety 517-241-6300	
Fire Alarm	State of Michigan Office of Fire Safety 517-241-6300	NFPA 72- 2019
Fire Suppression Systems	State of Michigan Office of Fire Safety 517-241-6300	NFPA 13- 2019
Local Code Authorities Having Jurisdiction		
Zoning	City of Lansing Dept of Zoning & Planning 517-483-4085	City of Lansing Zoning Ordinance
Fire	City of Lansing Fire Prevention 517-483-6048	IFC 2009
Fire Alarm	City of Lansing Fire Prevention 517-483-6048	NFPA 72- 2010
Fire Suppression Systems	City of Lansing Fire Prevention 517-483-6048	NFPA 13- 2019
Other Authorities		
Sanitary	City of Lansing Public Services 517-483-4463	
Local Utilities		
Water	Board of Water & Light Water Services 517-371-6034	
Gas	Consumers Energy Gas Engineering 517-374-2320	
Electric	Board of Water & Light Electro Services 517-371-6034	

Chapter 5 - Descriptive Compliance

d. Comply with State of Michigan Energy Code 2021 - Michigan Uniform Energy Code Rules, Part 10A; based ASHRAE standard for buildings except low-rise residential buildings, ANSI/ASHRAE/IESNA standard 90-1.2019 including appendices A, B, C, E, F, G, H, and I, With the amendments noted, adopted as effective April 22, 2023.

e. Comply with the Michigan Elevator Code which includes ASME A17.1-2016 Safety Code for Elevators and Escalators as amended by the State of Michigan and effective June 22, 2023.

f. Comply with the State of Michigan Mechanical Code 2021 based on IMC 2021 adopted and effective March 12, 2024.

g. Comply with State of Michigan Plumbing Code 2021 based on IPC 2021 adopted and effective March 12, 2024.

h. Comply with Michigan Electrical Rules, Part 5 based on NEC 2023 adopted as amended and effective March 12, 2024.

i. Comply with the State of Michigan State Fire Safety Rules, based on NFPA 101-2020 as amended and effective June 20, 2016.

11. Drawing Notes and Project Specifications may be presented in any or all of the following formats:

Descriptive: describes in detail the material to be used and the workmanship required to fabricate, erect and install the materials.

Performance: describes the general expectations of the final performance and result of that part of the project.

Reference: describes what reference standards are to be followed for a material, test method or installation procedure.

Prescriptive: describes what the Manufacturer, Model Number and/or options are to be used.

Contractor shall understand the difference between these formats and provide the proper results for each.

12. The following definitions apply generally to the work.

a. **Provide:** Furnish and install, complete and ready for intended use. All notes shall be considered as Provide unless specifically noted otherwise.

b. **Supply:** Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent operations.

c. **Install:** Operations at project site, including loading, unpacking, assembly, erection, placing, anchoring, applying, working in demolition, finishing, curing, and protecting, cleaning and similar, similar requirements.

d. **Connect:** Connect the necessary materials to connect items Furnished and assembled on site.

e. **Prepare:** Provide the necessary supports, rough opening, utility rough-in, base of sub-base, etc., for items to be installed by others.

f. **Indicated:** Shown on drawings by notes, graphics or schedule, or written into other portions of contract documents. Terms such as "shown", "shaded", "outlined", and "specified" have the same meaning as "indicated", and are used to assist the reader in locating particular information.

g. References to Contractor and/or Construction Manager that may be included in notes with this set of drawings shall mean either the Contractor or the Owner if there is not a General Contractor or Construction Manager.

13. All Contractors (General, Sub Contractors, Vendors and Suppliers) shall:

a. Provide all miscellaneous labor, equipment, parts and accessories necessary to install complete and fully functional building systems, whether such miscellaneous labor, equipment, part or accessory is specifically described herein or not. At the completion of the work, the building shall be fully functional and useable by the Owner.

b. Hold the contractor responsible to execute the contract for his project to the existing conditions. No additional payment will be provided by the owner for conditions that the Contractor could have identified through the pre-contract site visit.

c. Review all documents and shall notify the Architect in writing of any discrepancies or inadequacies prior to starting work.

d. Review and verify all dimensions and notify Architect in writing of any discrepancies prior to Start of Work.

e. Review and verify that the dimensions are coordinated.

f. Shall be satisfied that the documents indicate and provide for their work to be constructed, finished and functional. Commencement of work indicates acceptance of prior trades works. Completion of work shall provide that subsequent trades can complete their work.

g. Provide the highest quality of work and the greatest quantity of materials required for each project conforming to all noted codes, whether or not such materials required for such conformance are indicated in these plans.

h. Commencement of work shall indicate the Contractor's acceptance of these documents as being correct, complete and valid. Requests for changes on or after completion of work, without documents after Execution of Contract shall not be accepted.

i. Any omissions or conflicts between the various elements of the contract documents shall be brought to the attention of the Architect before proceeding with any work so involved. In the event of conflicts within the contract documents, the Architect shall render interpretation.

j. Do not scale these drawings. Use dimensions indicated on the drawings and those verified at the project site. The owner's representative shall clarify any dimensions or areas that are unclear on the drawings. Scaling of these drawings or other methods to determine dimensions will not be accepted. The owner's representative shall determine material quantities in these drawings. Discrepancies between actual conditions and the schematic information shown on drawings will not be cause for a change in the contract price or schedule.

14. Contractor shall:

a. Maintain the construction site in a neat and clean manner. he shall legally dispose of all unused material from the site. At the end of the project, the contractor shall clean all surfaces and remove all debris from the project site.

b. Provide access or access panels to all valves, dampers and other necessary adjustment items.

c. Where Demolition and/or removal of equipment exposes unfinished surfaces, openings, holes, missing trim, etc. Patch and repair surfaces to match adjacent surfaces so that demolition and removals can not be detected.

d. Coordinate with the mechanical and electrical contractors the location of ducts, piping, boxes, conduits, etc.

e. Provide adequate clearances for servicing of equipment per code.

f. Provide new mechanical patch, repair and refresh surfaces and supporting structure as required to provide new finished project in final condition.

g. Replace damaged materials with materials equal or better quality of the material that was damaged.

15. Contractor shall:

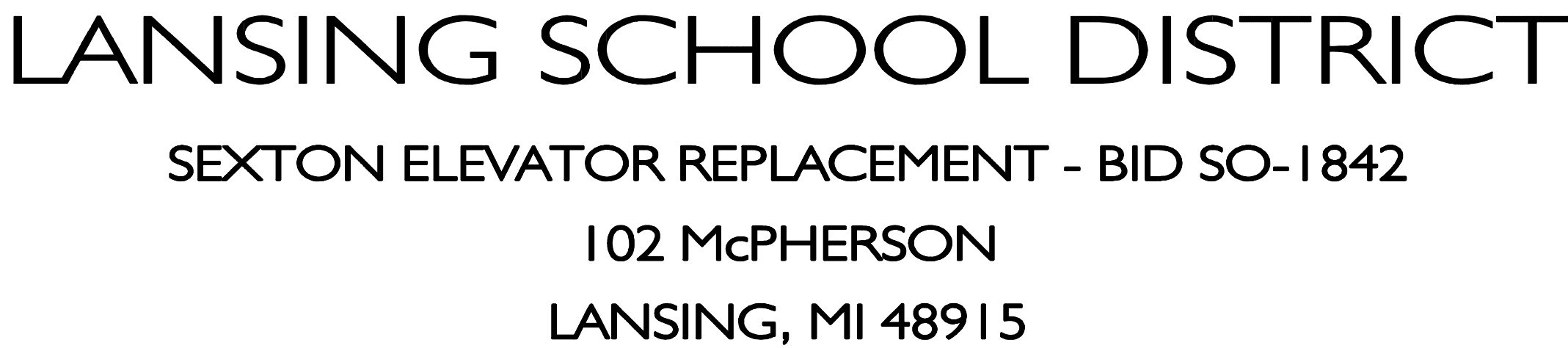
a. Each contractor be responsible for their own training, certification, licensing and permits and responsible for learning and complying with codes, standards or knowledge specific to their trade.

b. Obtain permits for building utilities such as water, electric, heat, etc. As necessary to complete project.

c. Include and pay for the cost of all labor and materials and all state sales and use taxes to complete the project in accordance with the documents.

d. Include, include and pay the cost of all building permits and/or fees necessary to complete the construction of this project, it's proper display and requests for inspectors from the local jurisdiction.

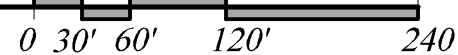
e. Furnish, supply in accordance with general conditions and as required by all state and local laws.



SCHOOL PLAN REVIEW INFORMATION		
Educational Facility - (K-12 School, Charter School, College, University and Dormitory)	State of Michigan Office of Fire Safety 517-241-6300	Fire Safety Rules adopting NFPA 101 -2012 as amended, effective June 20, 2016.
Facility Type:	High School	
Construction Type:	Type II (000)	NFPA 220 - 1995
Building Code	IBC 2015	
	82,250.0 sq. ft.	First Floor Main Building
	17,880.0 sq. ft.	First Floor Annex
	3,140.0 sq. ft.	First Floor Power House
	81,035.0 sq. ft.	Second Floor
	177,185.0 sq. ft.	Third Floor
	637,220.0 sq. ft.	Fourth Floor
	<u>637,220.0 sq. ft.</u>	Total Occupied Area
Sprinkler System	None	
Scope of Work	Main Building - Replace Front Doors, and stairway enclosure doors and glazing, and re paint frames. Annex - Add 3 Roof Top Units to Air Condition additional classrooms.	
Note, See §43.3.1.4	The work shall not make the building less conforming with the other sections of this Code, or any other previously approved alternative arrangements, than it was before the repair was undertaken.	

The site plan shows the UPMC campus layout. Michigan Avenue runs horizontally across the top. McPherson Avenue runs vertically on the right side. Allegheny Street runs horizontally at the bottom right. Key features include:

- PUMP HOUSE (SC)**: Located on the left side, near the top.
- PRESS BOX**: Located below the Pump House.
- FOOTBALL FIELD**: A large oval field with a grid pattern, located in the center-left.
- Project Area**: A large, irregularly shaped building footprint on the right side, highlighted in gray and labeled with a leader line.
- Other buildings**: Various rectangular building footprints are scattered throughout the site.
- Streets**: Michigan Avenue, McPherson Avenue, and Allegheny Street are clearly marked.



Other Drawings Including Architectural, Structural, Mechanical, Plumbing, and Electrical Drawings may have been Prepared by other Design Professional(s) and are not part of this Drawing Set.	
DEFERRED SUBMITTALS	
NONE	
SPECIAL INSPECTIONS	
NONE	
Contractor shall provide Fire Alarm Drawings and Calculations, prepared by a Fire Alarm Engineer licensed in the State of Michigan in accordance with Michigan Building Code, Section 107.2.2, Section 907.1 and containing information as required by NFPA 72 - 2013, Sections 5-1, 1-6.	
Contractor shall provide Fire Suppression System, Monitoring, Alarm and Notification Drawings and Calculations, prepared by a Fire Protection Engineer licensed in the State of Michigan in accordance with Michigan Building Code, including Sections 107.2.2 & Section 903 and Michigan Mechanical Code Chapter 16 and containing information as required by NFPA 13 - 2013, Chapter 8.	
Also, in accordance with State of Michigan Bureau of Fire Services, 2016 New and Existing School Rules, Including Rule 4.	
Submit Drawings to State of Michigan Bureau of Fire Services and Bureau of Construction Codes	
DESIGN PROFESSIONALS:	
Architect:	Roger Donaldson AIA Roger L. Donaldson, AIA P.L.C. 4757 Tartan Lane Holt, Michigan 48842-1935 (517) 694-0011 RogerAIA@comcast.net
Mechanical & Electrical Engineering	Craig Treweiler P. E. MATRIX Consulting Engineers, INC. 1601 E. Chasewave Avenue Lansing, MI 48906 (517) 487-2511 Phone (517) 487-2544 Fax
Elevator Consultant	Lorch Bates BUILDING INSIGHT 4995 Bradenton Ave, Suite 200 Dublin, OH 43017 (614) 648-8961 Project #100054544

REVISIONS			

DRAWN			
RLD			

APPROVED			
RLD			

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 McPHERSON
LANSING, MI 48915

SHEET DESCRIPTION	
TITLE SHEET, CODE DATA, DRAWING INDEX, SITE PLAN & PROJECT INFORMATION	
DATE	
09/26/2025	
PROJECT NUMBER	
24448.00	
SHEET NUMBER	
G 0.1	

FILE NO.
25-06 A001

PLOT DATE & TIME: Friday, September 26, 2025 8:39 AM

 $\sigma_{\text{max}} = 8/14 \text{ MPa} = 0.57 \text{ MPa}$

Drawing File: D:\Projects\Clients\25\25-06\25-06 ACCL.aoc

Detail Number
Sheet where Detail is shown

Interior Elevation Number
Sheet where Interior Elevation is shown

Room Name
Existing Room Name
Room Area sq.ft.
Room # of Occupants
Room Number

Room Name
New Room Name
Room Area sq.ft.
Room # of Occupants
Room Number

Existing Door Number
New Door Number

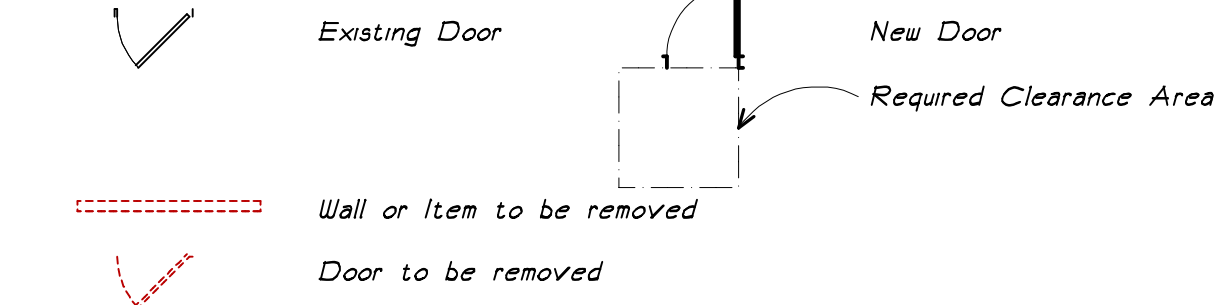
Existing Wall
New Wall

Existing Door
New Door

Required Clearance Area

Wall or Item to be removed

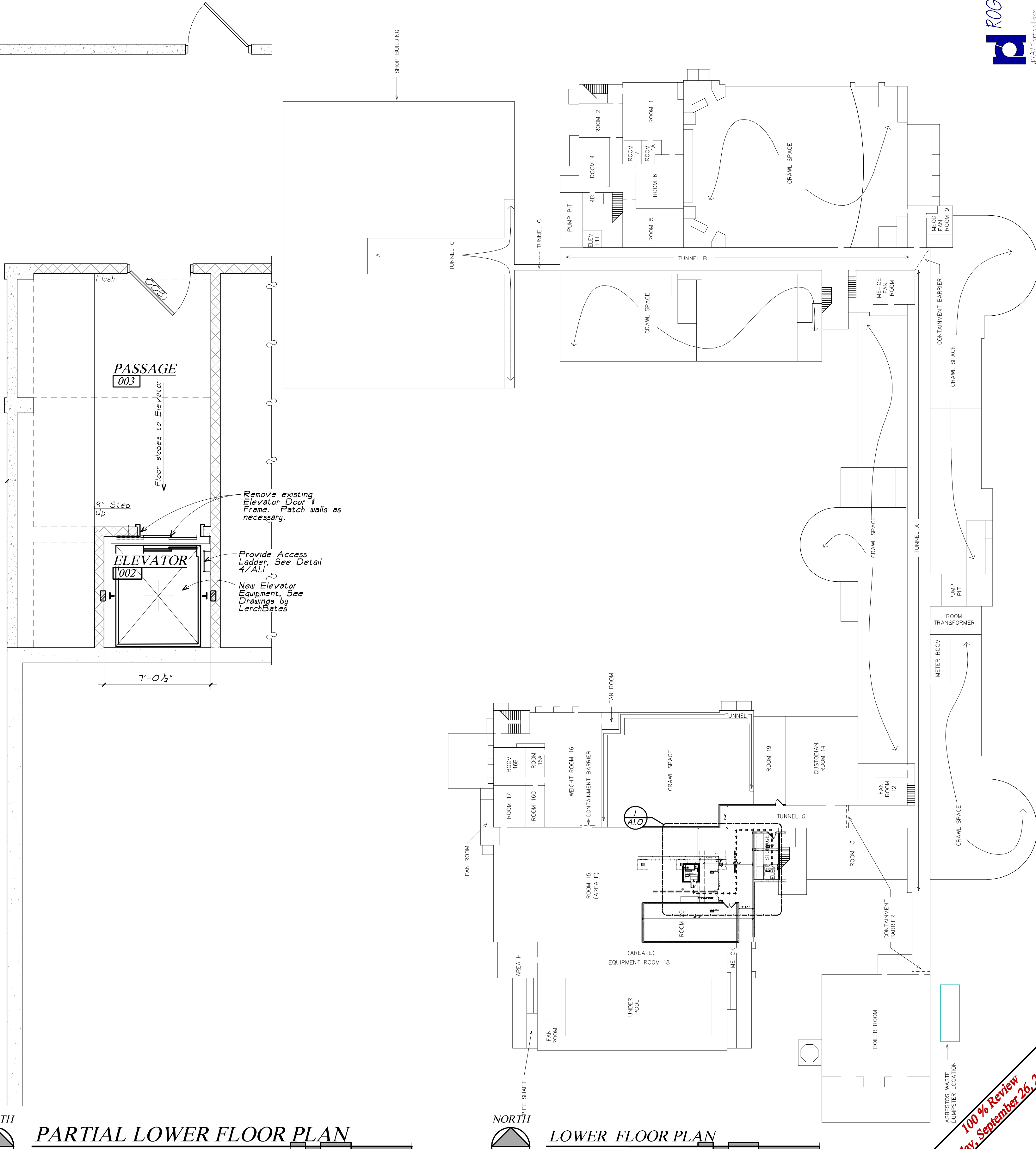
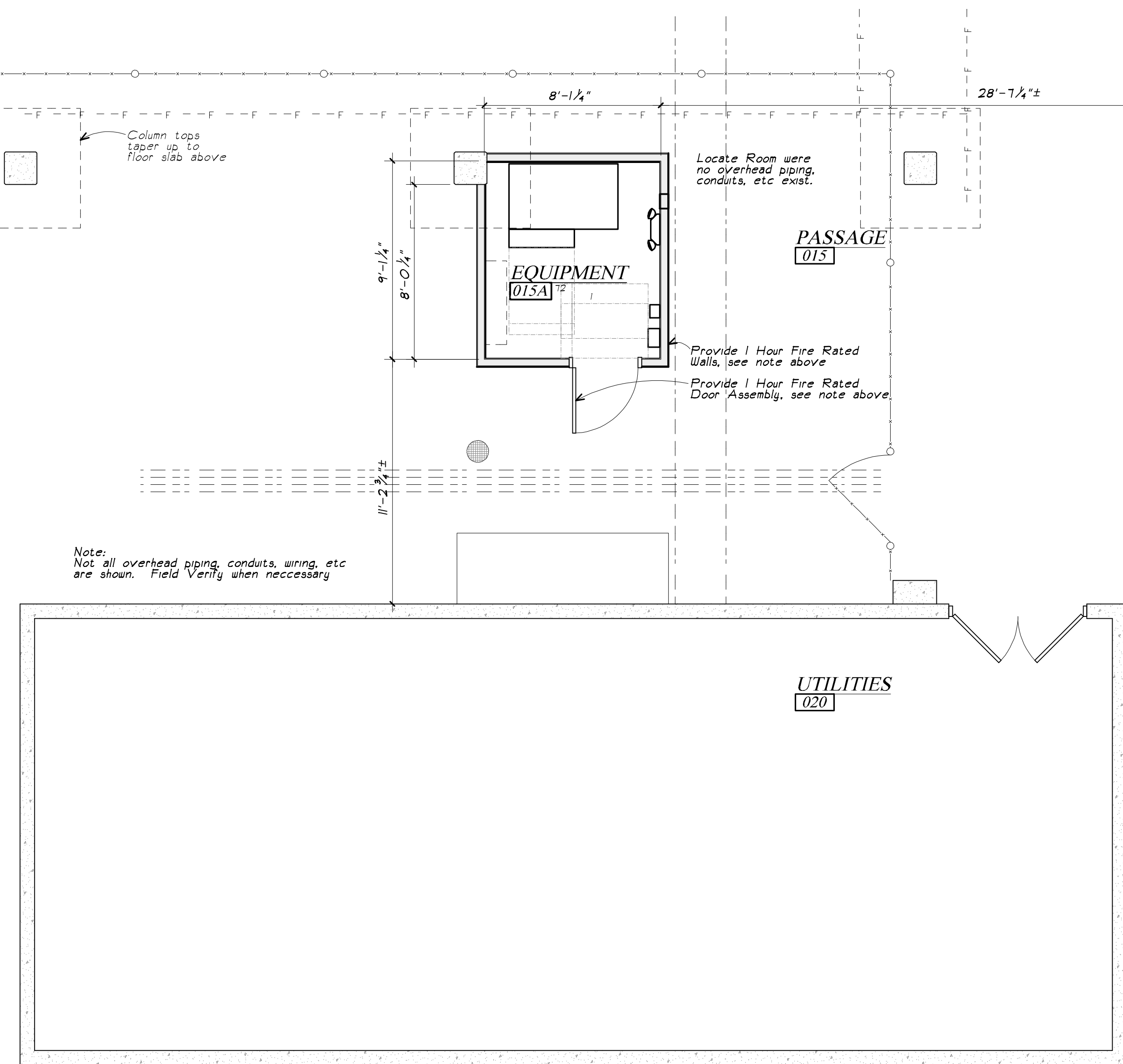
Door to be removed



New Wall - UL Design #U465 - 1 Hour
5/8" Gypsum Drywall, type "X" each side of 3/8" x 25 gauge
Metal Studs at 24" O.C. Provide 3/4" x 25" Friction fit
insulation (R-15) and 4 mil vapor barrier on
exterior of wall studs.
Seal to floor and concrete floor slab above

Paint both sides of walls
Exposed concrete floor slab and floor slab above

New Door, shall be minimum 3'-0" wide x 7'-0" tall 1 Hour Fire
Rated Hollow Metal Door and Frame. Provide with Door, 3
Hinges, Lever Storage Lockset and Closer.



rd ROGER L. DONALDSON, AIA P.L.C.
ARCHITECT
1957 Toronto | 090

REVISIONS			
DRAWN			
		RLD	
APPROVED			
		RLD	

MATRIX
CONSULTING ENGINEERS, INC.

544 CHERBOUGH DRIVE
LANSING, MI 48917
PHONE (517) 487-2511
admin@matrixenginc.com
Matrix Project No. 24448-00

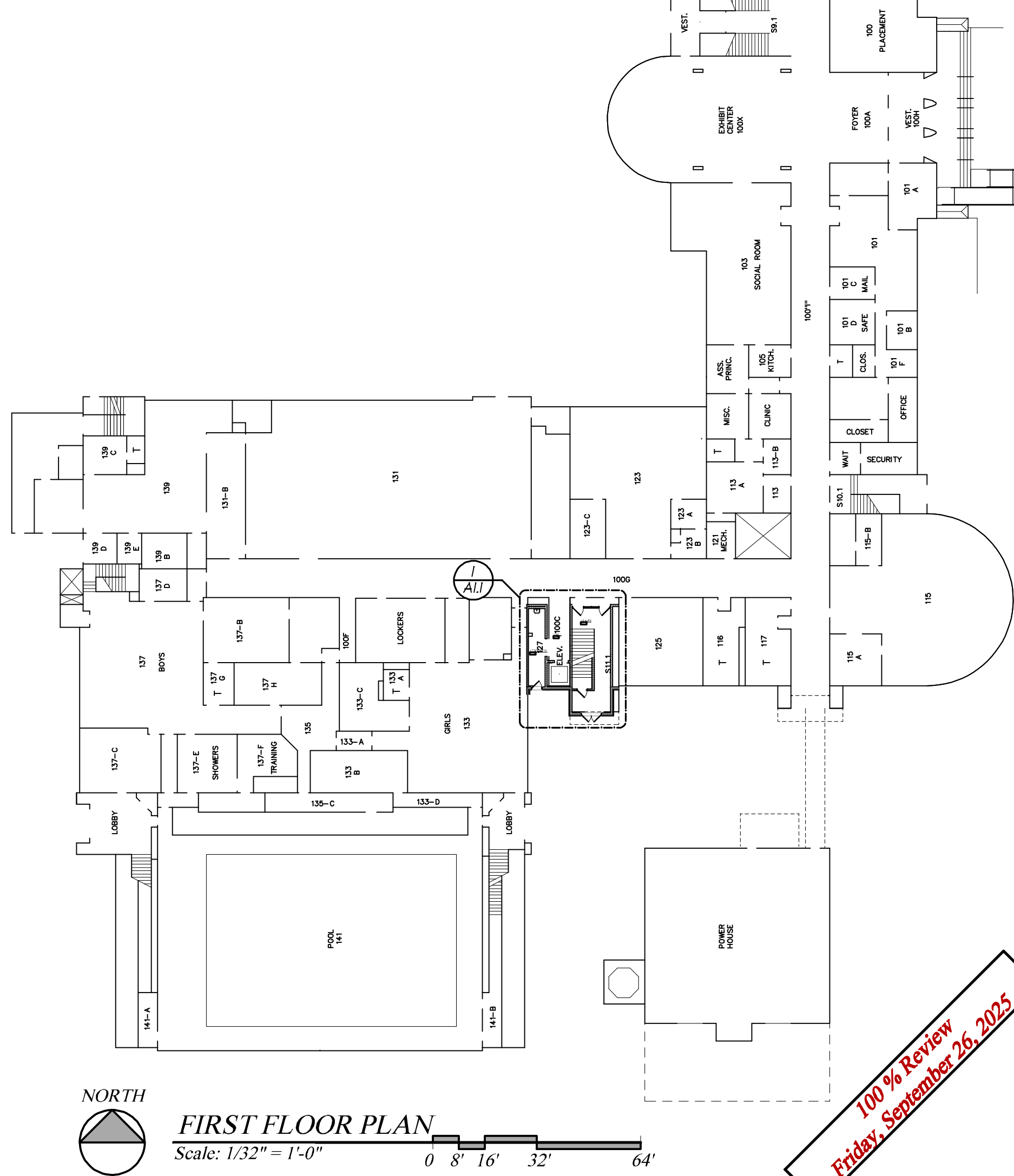
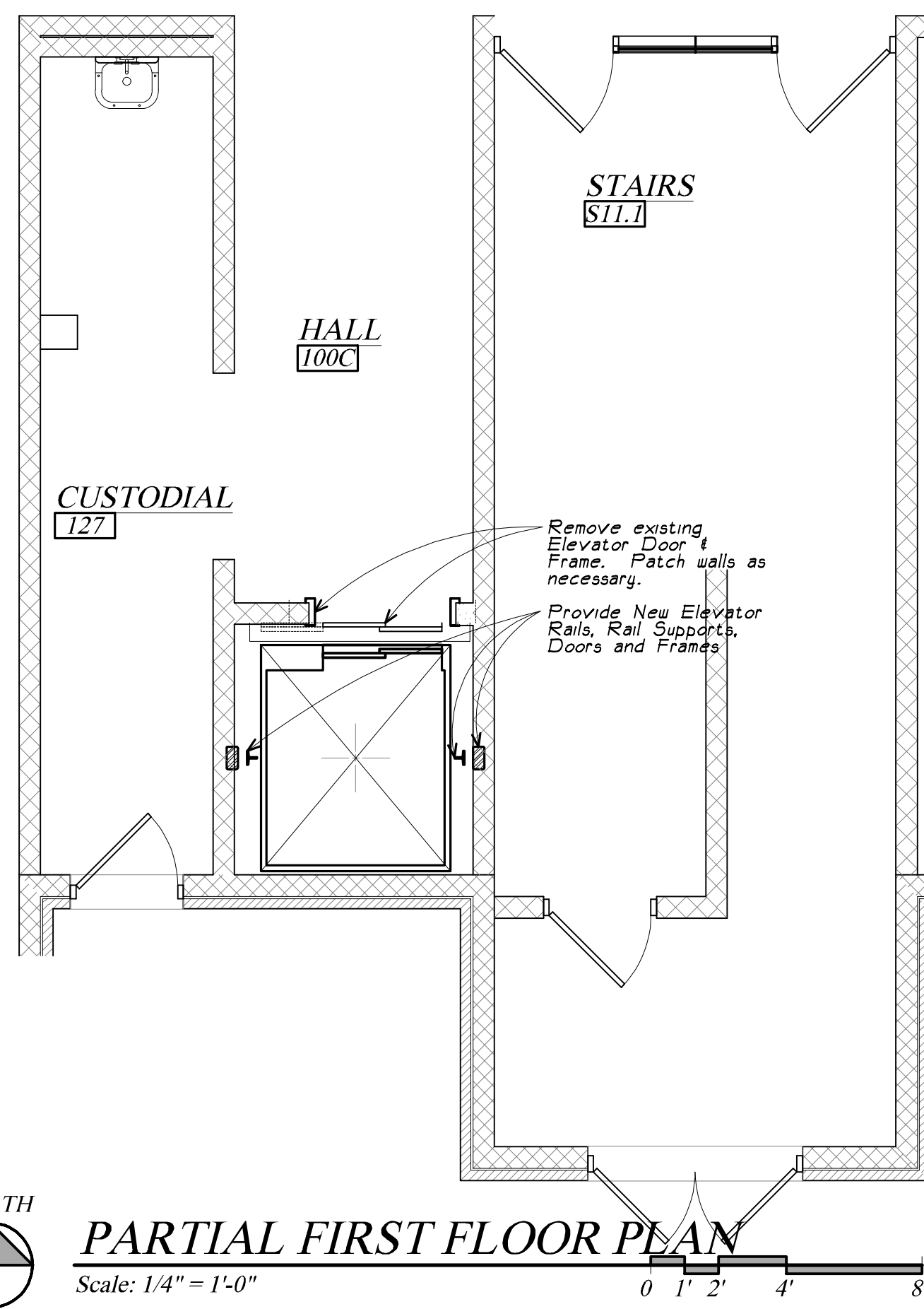
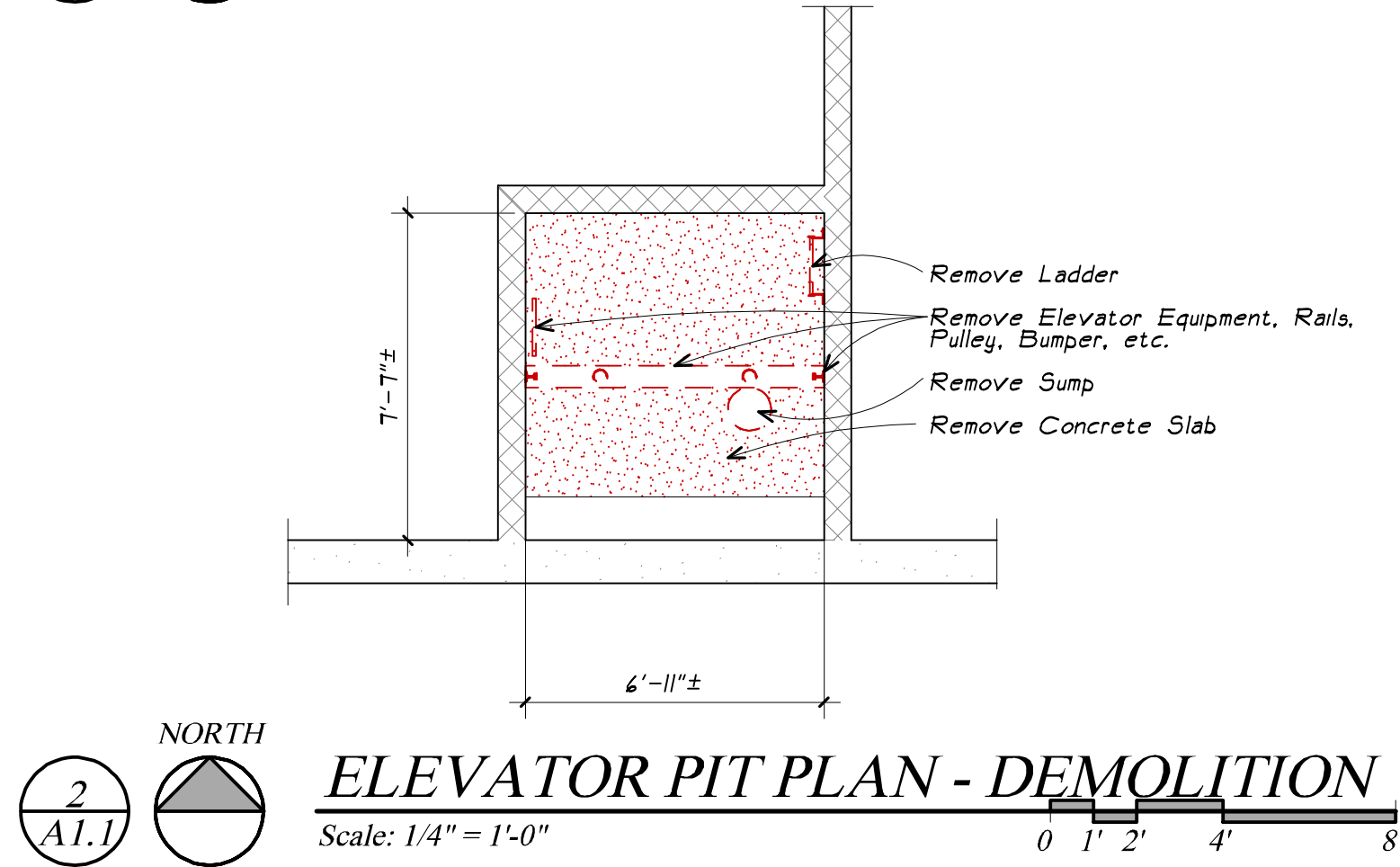
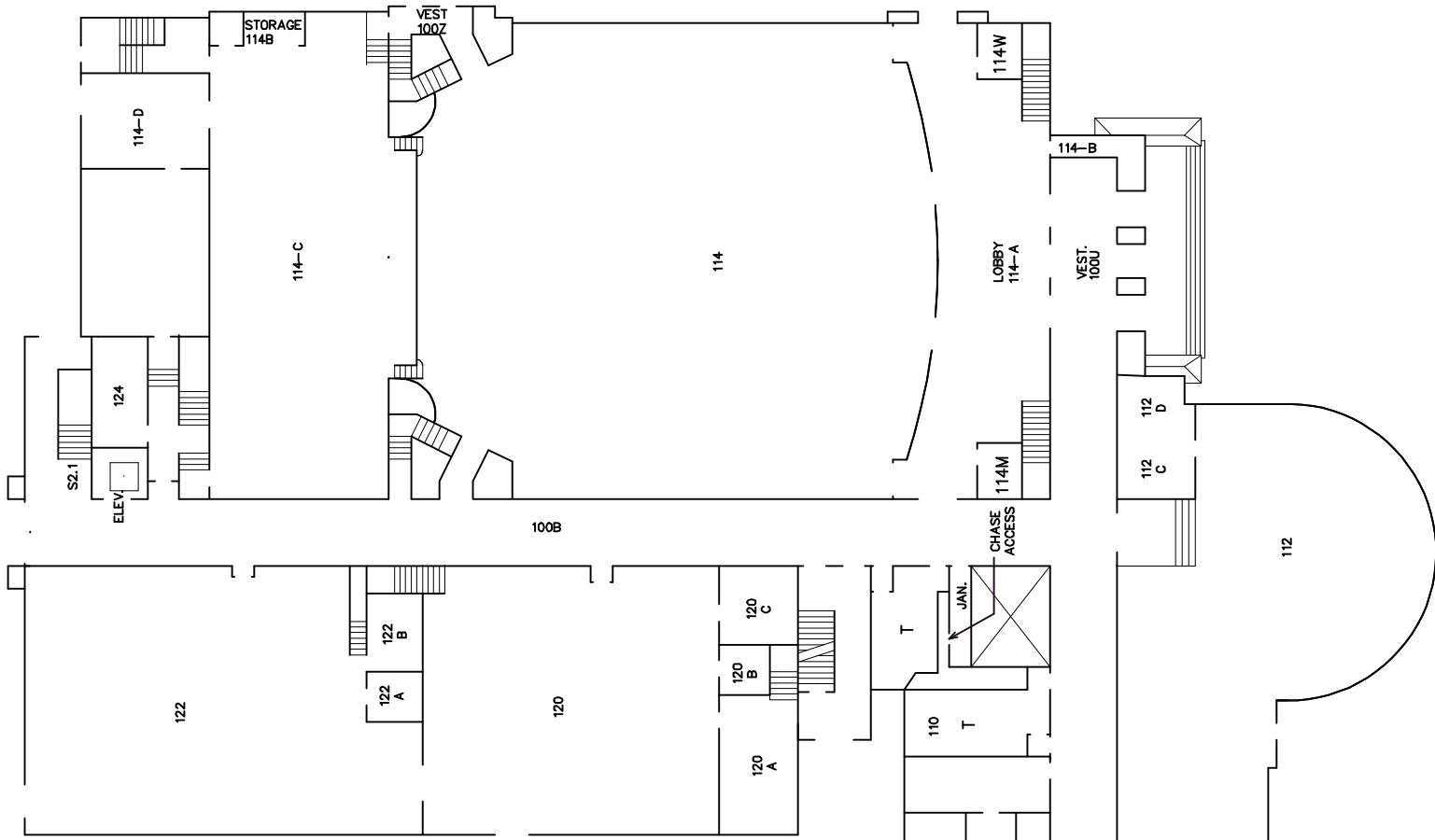
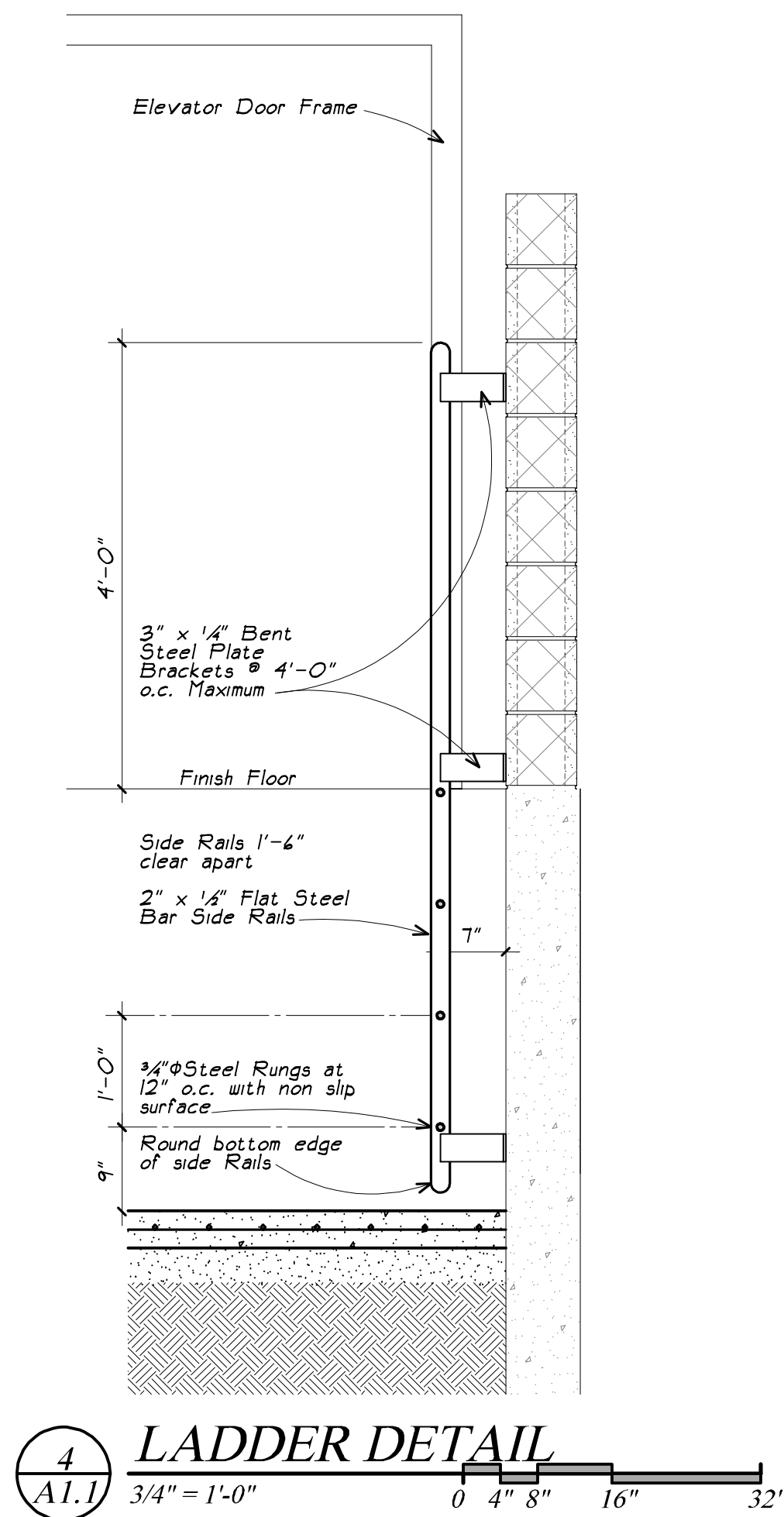
LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 McPHERSON
LANSING, MI 48915

SHEET DESCRIPTION	
LOWER LEVEL PLAN, PLAN NOTES, TOILET ELEVATIONS	
DATE	09/26/2025
PROJECT NUMBER	24448.00
SHEET NUMBER	
AI.0	

ASBESTOS WASTE
DUMPSTER LOCATION

100 % Review
Friday, September 26, 2025

1. Do not scale these drawings, use dimensions indicated on the drawings and those verified at the project site. Any dimensions or areas that are unclear on the drawings shall be clarified by the Owner's Representative. Scaling of these drawings or other methods to determine dimensions will not be acceptable.
2. When references are made for Contractor, that includes Owner self performing construction work.
3. Contractors shall review and verify all dimensions and shall notify Architect of any discrepancies.
4. Contractor shall maintain Project in a dry condition at all times.
5. Contractor shall be responsible for protection and safekeeping of all products stored at the site and within the building.
6. The Contractor shall assume that he may be required to provide the highest quality of work and the greatest quantity of materials required for a complete project conforming to all noted codes, whether or not such materials required for such performance are indicated in these plans.
7. Contractor shall properly store materials in accordance with manufacturer's instructions or recommendations. All materials shall be stored in a dry and safe manner. Materials that become wet shall be replaced or properly dried out prior to being used in the Project.
8. Egress doors shall be readily operable from the egress side without the use of a key or special knowledge or effort. (MBC §1070.1.5)
9. Door handles, pulls, latches, locks and other operating devices on doors shall not require tight grasping, tight pinching or twisting of the wrist to operate. (MBC §1070.1.8.1)
10. All items of demountable salvageable value shall be placed in Owner's storage unless instructed otherwise.
11. All Hardware shall be turned over to Owner.
11. Coordinate all demolition work with individual trades to minimize conflicts.
12. The structural integrity of the building shall not be altered.
13. The Contractor shall field verify all conditions for removal of all components necessary for coordination with the existing structure. These drawings are for general demolition and are not intended to be used as drawings or "as built" drawings. All work that interferes with new construction, whether shown or not shown, shall be removed or relocated as directed by the Architect or Owner's representative.
14. Provide dust protection to all occupied areas, especially those containing computer and/or electronic systems.
15. Where Demolition exposes or damages surfaces to be exposed in final project, patch, repair and refinish etc. Patch and repair surfaces as required to provide new finished project.
16. Where Demolition and/or removal of adjacent surfaces unfinished surfaces, openings, holes, missing trim etc. Patch and repair surfaces to match adjacent surfaces so that demolition and removals can not be detected.



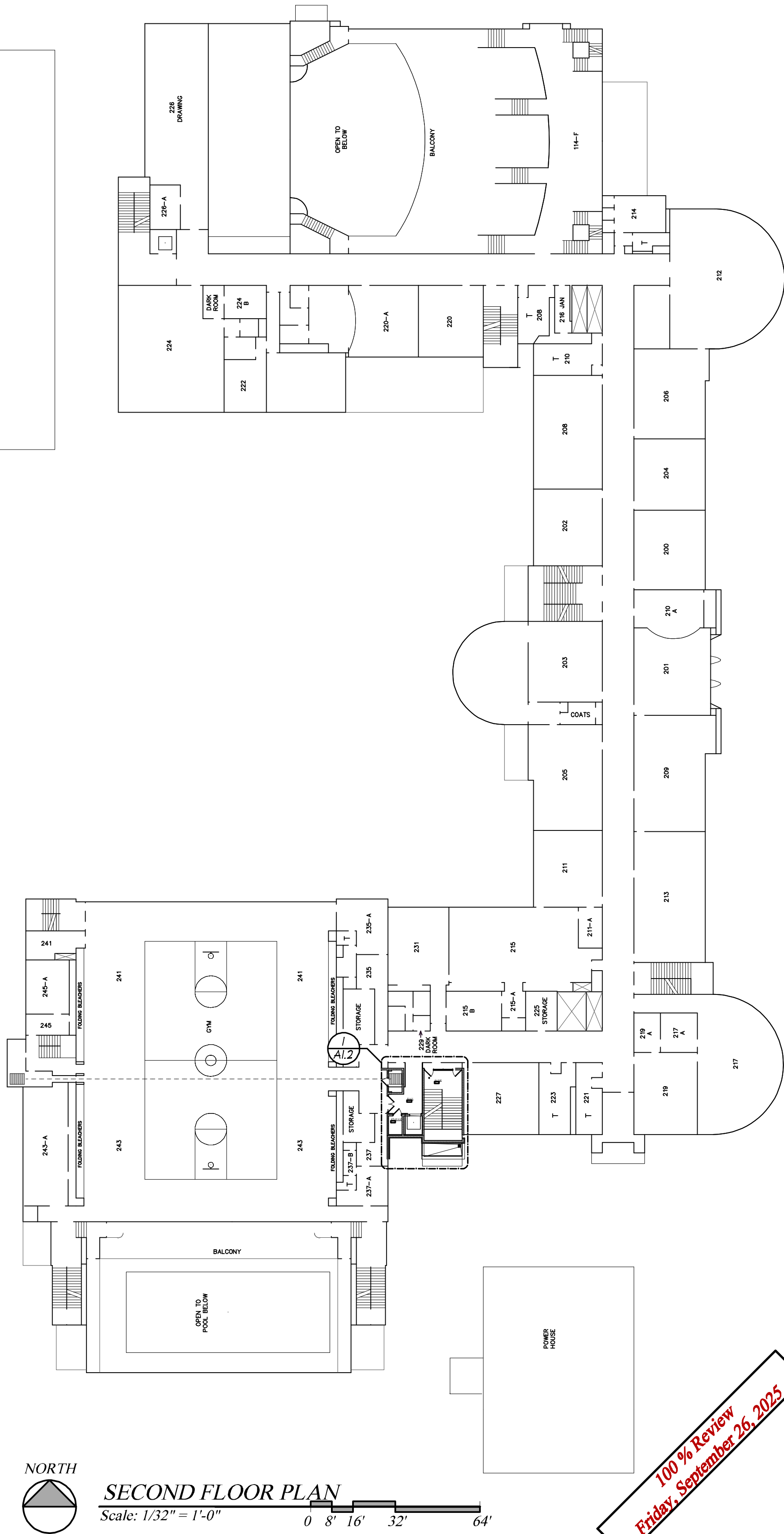
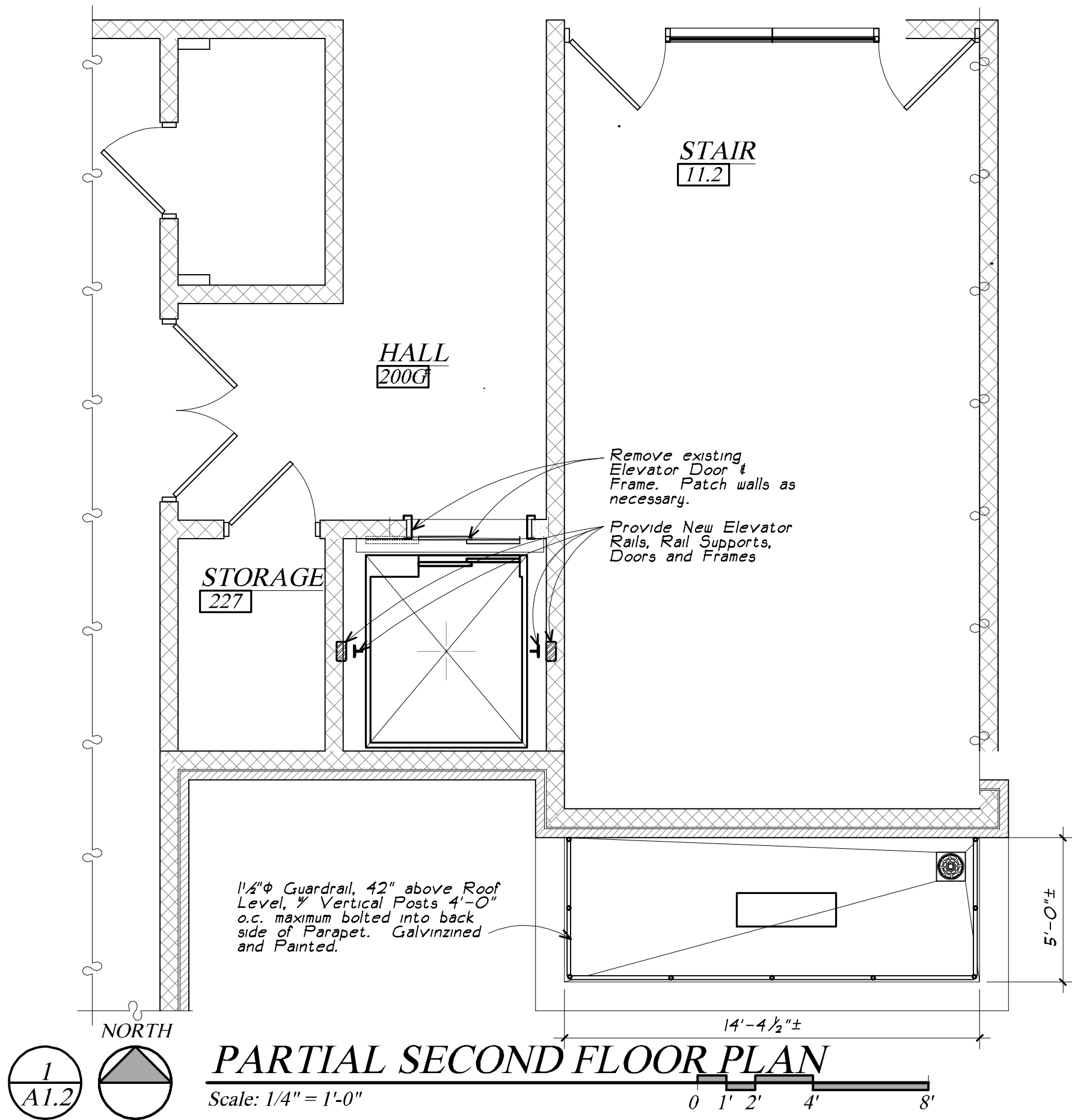
MATRIX
CONSULTING ENGINEERS, INC.

544 CHERBOUGH DRIVE
LANSING, MI 48917
PHONE (517) 487-2511
admin@matrixenginc.com
Matrix Project No. 24448.00

SHEET DESCRIPTION
FIRST FLOOR PLAN, FIT PLAN, FIT PLAN - DEMOLITION, DETAILS & PLAN NOTES
DATE 09/26/2025
PROJECT NUMBER 24448.00
SHEET NUMBER A1.1

Holt,
Michigan 48842-1835
(517) 694-0011 **Project #25-06** email: RogerAla@comcast.net

100 % Review
Friday, September 26, 2025



ROGER L. DONALDSON, AIA P.L.C.
ARCHITECT

4181 Tartar Lane
Hills, Michigan 48242-8835
Phone: (577) 654-0011 email: Roger@Rldonaldson.net

Project #25-06

REVISIONS	

DRAWN
RLD

APPROVED
RLD

MATRIX
CONSULTING ENGINEERS, INC.

544 CLEVERIDGE DRIVE
LANSING, MI 48917
PHONE (517) 487-2511
admin@matrixinc.com
Matrix Project No. 24448.00

PROJECT

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 McPHERSON
LANSING, MI 48915

SHEET DESCRIPTION

**SECOND FLOOR
PLAN & PARTIAL
SECOND FLOOR
PLAN**

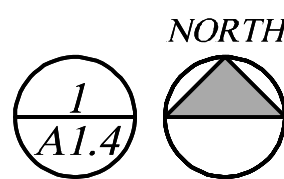
DATE
09/26/2025

PROJECT NUMBER
24448.00

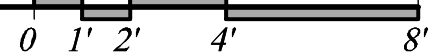
SHEET NUMBER
A1.2

FILE NO.
25-06 A100

100% Review
Friday, September 26, 2025

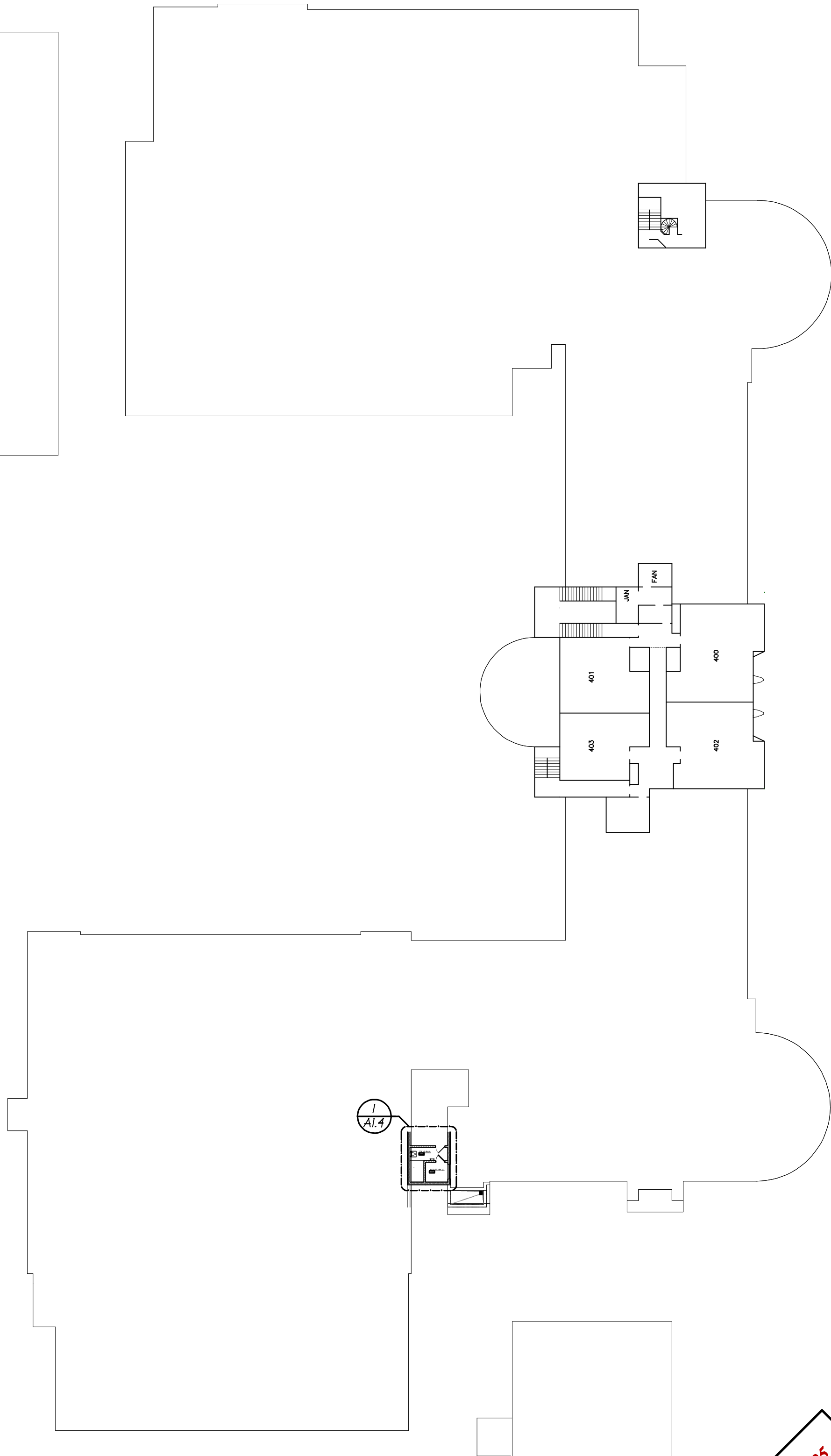
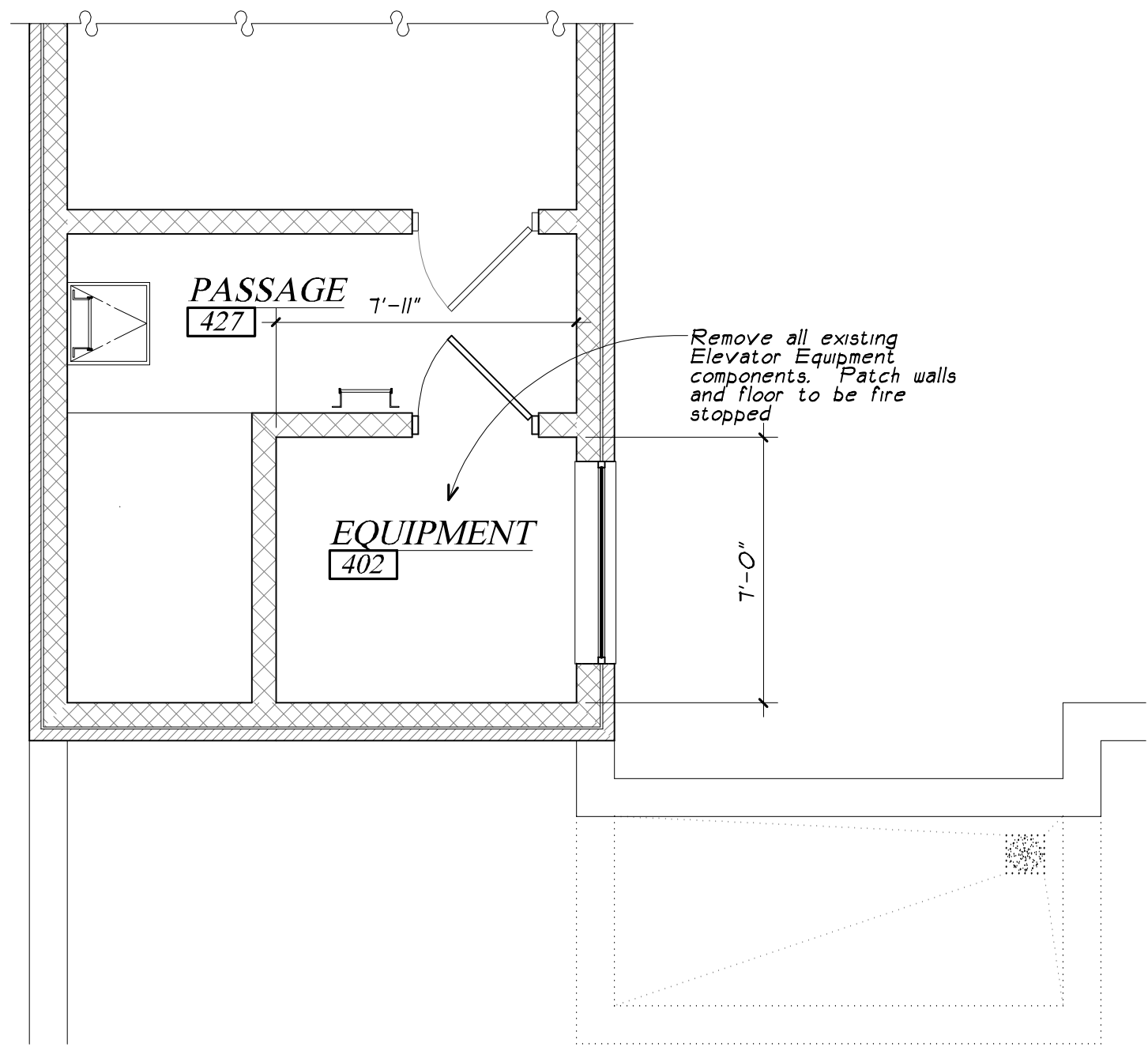
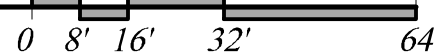


PARTIAL FOURTH FLOOR PLAN
Scale: 1/4" = 1'-0"



FORTH FLOOR PLAN

Scale: 1/32" = 1'-0"



100 % Review
Friday, September 26, 2025



ROGER L. DONALDSON, AIA P.L.C.
ARCHITECT

4737 Tartar Lane
Holt,
Michigan 48842-1935
(517) 694-0011 **Project #25-06** email: RogerAlla@comcast.net

REVISIONS			
DRAWN			
			RLD
APPROVED			
			RLD

MATRIX
CONSULTING ENGINEERS, INC.

544 CHERBOURGH DRIVE
LANSING, MI 48917

PHONE (317) 487-2511

admin@matrixinc.com
Matrix Project No. 244465.00

PROJECT

LANSING SCHOOL DISTRICT

SEXTON ELEVATOR REPLACEMENT - BID SO-1842

102 McPHERSON

LANSING, MI 48915

**FOURTH FLOOR PLAN &
PARTIAL FOURTH FLOOR
PLAN**

DATE 09/26/2025

PROJECT NUMBER	24448.00
----------------	----------

SHEET NUMBER

AI.4

VT01 GENERAL ELEVATOR INFORMATION
VT02 PLANS AND HOISTWAY SECTION - ELEVATOR 1

1 INDEX OF DRAWINGS
VT01 SCALE: NTS

ELEVATOR NUMBER	CAPACITY (#)	SPEED (FPM)	APPLICATION
1	3000	125	IN-GROUND HYDRAULIC

2 SUMMARY OF ELEVATORS
VT01 SCALE: NTS

AFF	ABOVE FINISH FLOOR	EQ	EQUAL EQUIPMENT	MG	MOTOR-GENERATOR	UNO	UNLESS NOTED OTHERWISE
A/C	AIR CONDITIONING	ESCL	ESCALATOR	MTD	MOUNTED	V.I.F.	VERIFY IN FIELD
ALT.	ALTERNATE	(E)	EXISTING	NEC	NATIONAL ELECTRICAL CODE	VERT.	VERTICAL
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	#F	FAHRENHEIT	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION	V.	VOLT
AMP	AMPERE	FPM	FEET PER MINUTE			W.	WIDE
APPROX.	APPROXIMATE	F.V.	FIELD VERIFY			W/	WITH
ARCH.	ARCHITECTURAL	F.F.	FINISH FLOOR	(N)	NEW	WP	WORKPOINT
AHJ	AUTHORITY HAVING JURISDICTION	FLR	FLOOR	N	NEWTONS		
AUX	AUXILIARY	FT (')	FOOT (FEET)	N/A	NOT APPLICABLE		
BSMT	BASEMENT	fc	FOOT CANDLE	NTS	NOT TO SCALE		
BOT.	BOTTOM	F	FRONT OPENING	NO.	NUMBER		
Btu/h	BRITISH THERMAL UNITS PER HOUR	FUT.	FUTURE	O.C.	ON CENTER		
BOCA	BUILDING OFFICIALS AND CODE	GA	GAUGE	OPNG	OPENING		
CLG	CEILING	GOV.	GOVERNOR	OPP.	OPPOSITE		
°C	CELSIUS	G	GRAVITY	O.A.	OVERALL		
¢	CENTERLINE	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	OVHD	OVERHEAD		
cm	CENTIMETERS	HT	HEIGHT	PL	PLATE		
CLR	CLEAR	HZ	HERTZ	PLTFM	PLATFORM		
COL.	COLUMN	HSTWY	HOISTWAY	#	POUNDS		
CONC.	CONCRETE	HORIZ.	HORIZONTAL	psi	POUNDS PER SQUARE INCH		
CONJ.	CONCRETE MASONRY UNITS	hp	HORSEPOWER	PRELIM.	PRELIMINARY		
CONT.	CONTINUOUS	hr	HOUR	RAD.	RADIUS		
CONTR.	CONTRACTOR	IBC	INTERNATIONAL BUILDING CODE	R	REAR OPENING		
CONTR.	CONTRACTOR	IGBT	INSULATED GATE BIPOLAR TRANSODUCER	REQ.	REQUIRED		
COORD	COORDINATE	INT.	INTERNATIONAL BUILDING CODE	REV.	REVISION		
CWT	COUNTERWEIGHT	in. (")	INCH (INCHES)	RH	ROUGH OPENING		
CYL.	CYLINDER	ISC	INCHES PER SECOND	R.O.	ROUGH OPENING		
DEH	DEAD END HITCH	J	JOULES PER SECOND	SEC.	SECONDARY		
°	DEGREES	Kcal	KILOCALORIE	SECT.	SECTION		
DTL	DETAIL	Kg	KILOGRAMS	SCR	SHORT CIRCUIT		
Ø	DIAMETER	KN	KILONEWTONS	SCR	SILICON CONTROLLED RECTIFIER		
DIM.	DIMENSION	kPa	KILOPASCALS	SIM.	SIMILAR		
DC	DIRECT CURRENT	kVA	KILOVOLT-AMPERE	SPEC.	SPECIFICATION		
DISC.	DISCONNECT	kWh	KILOWATT HOUR	sq.ft.	SQUARE FEET		
DBG	DISTANCE BETWEEN GUIDE RAILS	kw	KILOWATTS	sq.m	SQUARE METERS		
DN	DOWN	k	KIPS	STD	STANDARD		
DWG	DRAWING	LT	LIGHT	SBC	STANDARD BUILDING CODE		
EA	EACH	MACH.	MACHINE	STL	STEEL		
ELEC.	ELECTRICAL	MRL	MACHINE ROOM LESS	STRUCT.	STRUCTURAL		
ELEV.	ELEVATION	MAX.	MAXIMUM	SW.	SWITCH		
ETS	EMERGENCY TERMINAL SLOWDOWN	m	METERS	TBD	TO BE DETERMINED		
		m/s	METERS PER SECOND	T.O.	TOP OF		
		mezz.	MEZZANINE	(TYP)	TYPICAL		
		mm	MILLIMETERS	UBC	UNIFORM BUILDING CODE		
		MIN.	MINIMUM				
		MISC.	MISCELLANEOUS				

3 ABBREVIATIONS
VT01 SCALE: NTS

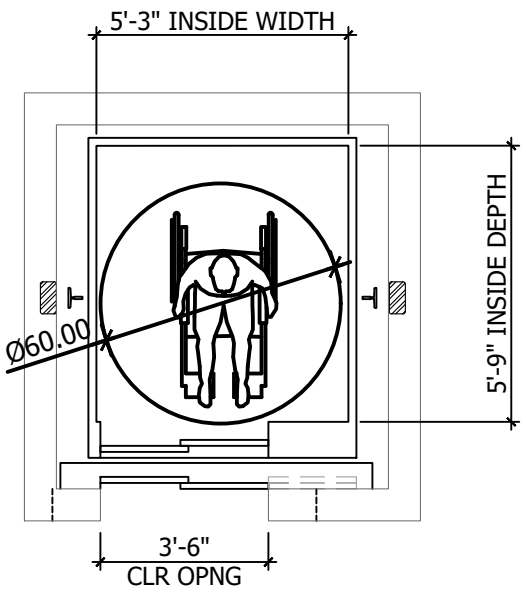
POWER FEEDER REQUIREMENTS (MAIN POWER SUPPLY: 480-3-60)									
ELEVATOR NUMBER	CAPACITY (POUNDS)	SPEED (FPM)	HYDRO PUMP HP (PER MOTOR)	HYDRO STARTING AMPS			FULL LOAD AMPS (PER MOTOR)	HEAT RELEASE	
				LOCKED ROTOR	SOLID STATE	WYE DELTA		CONTROLLER SPACE	MACHINE SPACE
1	3000	125	60	399	216	126	72	23,730*	COMBINED
* HEAT RELEASE BASED ON 80 UPSTARTS/HR									
ADDITIONAL POWER AND DISCONNECT REQUIREMENTS IN MACHINE ROOM									
AUXILIARY SYSTEM			SUPPLY TERMINAL			SUPPLY VOLTAGE		CIRCUIT CAPACITY	
CAR LIGHT AND FAN WITH LOCKABLE DISCONNECT			EACH CONTROLLER			120-1-60		17 AMP PER CAR	
INTERCOM SYSTEM (IF APPLICABLE)			AT AMPLIFIER			120-1-60		1800 WATTS (15 AMP MIN.)	

- NOTES:
- ELECTRICAL POWER AND CURRENT ARE BASED ON THREE (3) PHASE A.C. POWER SUPPLY.
 - MAIN POWER TO BE PROVIDED AT EACH CONTROLLER THROUGH DISCONNECTING MEANS MEETING NEC REQUIREMENTS.
 - MAIN POWER SUPPLY FEEDERS TO LIMIT VOLTAGE DROP TO LESS THAN 5% MAX. SCCR FOR ALL DISCONNECT FEEDER DESIGNS BASED ON 3KA RATING (NEC SECTION 409.022 AND UL506A SUPPLEMENT SB).
 - USE COPPER CONDUCTORS ONLY.
 - FEEDER DEMAND FACTORS (NEC SECTION 430.026 AND 620.014) =
(2) CARS = 95%, (3) CARS = 90%, (4) CARS = 85%, (5) CARS = 82%, (6) CARS = 79%, (7) CARS = 77%, (8) CARS = 75%, (9) CARS = 73%, (10) CARS = 72%.
 - MACHINE/CONTROL ROOM OR MACHINE/CONTROL SPACE TEMPERATURE TO BE MIN. 55° F (13° C), MAX 90° F (32° C). TO BE MEASURED 6'-0" (1838mm) ABOVE FINISH FLOOR AT APPROXIMATELY CENTER OF ROOM.
 - RELATIVE HUMIDITY MAX 80% NON-CONDENSING.
 - THE SELECTION OF MAIN POWER SUPPLY DISCONNECTING MEANS OVER CURRENT PROTECTION TO BE SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE, SECTIONS 620.051 AND 430.052.
 - PROVIDE LOCAL TELEPHONE SERVICE LINE TO EACH CAR CONTROLLER (IF APPLICABLE).
 - PROVIDE GFCI CONVENIENCE OUTLETS IN PIT, MACHINE ROOM AND IN MACHINERY SPACES. IN PIT, PROVIDE ONE NON-GFCI OUTLET FOR SUMP PUMP AND/OR OIL RETURN PUMP.
 - PROVIDE HOIST MACHINE WITH VOLTAGE TO MATCH SUPPLY VOLTAGE INDICATED. U.N.O.

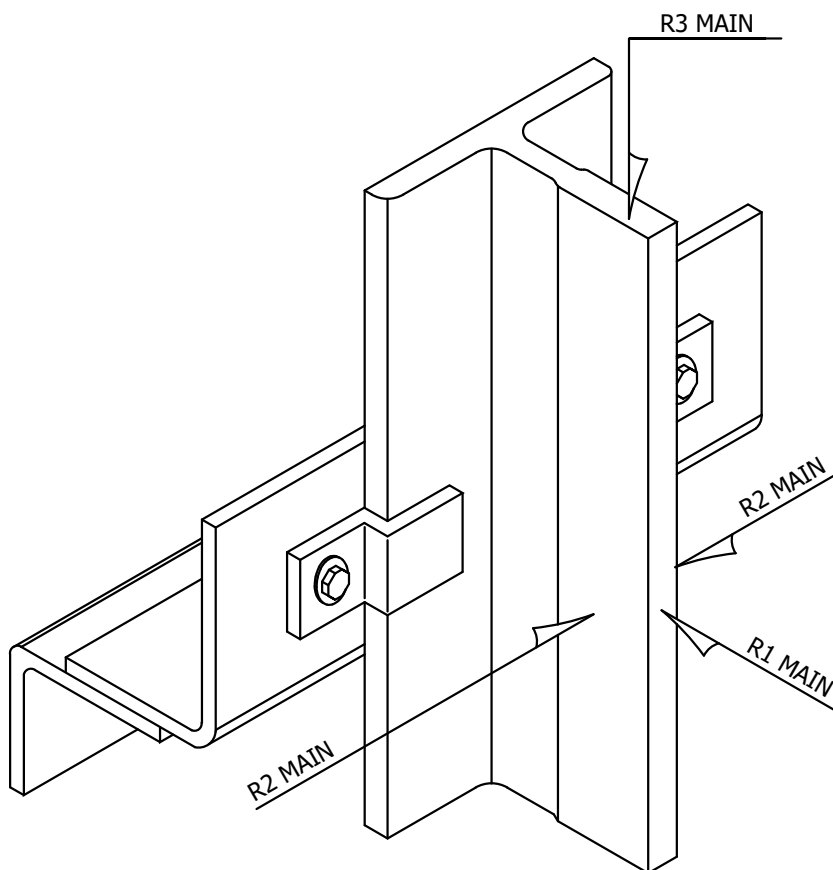
4 ELEVATOR ELECTRICAL AND MECHANICAL REQUIREMENTS
VT01 SCALE: NTS

- THESE DRAWINGS FOR GENERAL INFORMATION ONLY. REQUIREMENTS OF INDIVIDUAL VENDORS MAY VARY.
- THESE DRAWINGS TO BE DISTRIBUTED TO APPROPRIATE CONSULTING AND ENGINEERING FIRMS, INCLUDING ARCHITECT, STRUCTURAL, ELECTRICAL AND MECHANICAL ENGINEERS.
- ROUGH OPENING DIMENSIONS FOR ELEVATOR ENTRANCES APPLY ONLY IN THE CASE OF MASONRY OR CONCRETE CONSTRUCTION.
- VERTICAL STRUCTURAL SUPPORT FOR RAIL BRACKETING IS PROVIDED BY HOISTWAY WALLS IN THE CASE OF REINFORCED CONCRETE HOISTWAY CONSTRUCTION.

5 GENERAL NOTES
VT01 SCALE: NTS



6 ACCESSIBILITY DIAGRAM
VT01 SCALE: 1/4" = 1'-0"



RAIL FORCES OCCURRING ON:
NORMAL FORCES:
CAR R1 - FORCE APPLIED TO FACE OF MAIN RAIL
CAR R2 - FORCE APPLIED TO SIDE OF MAIN RAIL - LOADING OR RUNNING
CAR R3 - FORCE TRANSMITTED TO PIT STRUCTURE AT CAR SAFETY APPLICATION¹

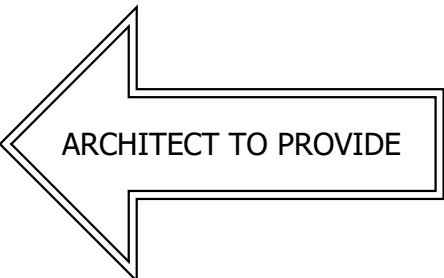
NORMAL FORCES:

BUILDING SUPPORTS TO RESIST HORIZONTAL FORCES, AT THE POINT OF SUPPORT, WITH A TOTAL MAXIMUM DEFLECTION NOT TO EXCEED 1/8" (3mm) UNDER NORMAL CONDITIONS. ALLOWABLE DEFLECTION CRITERIA TO BE DIVIDED IN HALF BETWEEN STRUCTURAL (1/16") AND AWARDED MANUFACTURER (1/16").

- ¹ = THESE REACTIONS DO NOT OCCUR SIMULTANEOUSLY WITH PIT BUFFER REACTIONS

ELEVATOR NUMBER	NORMAL FORCES (IN KIPS)			
	CAR R1	CAR R2	CAR R3	CWT R3
1	1.1	0.8	N/A	N/A

SEISMIC INFORMATION			
SEISMIC DESIGN CATEGORY	ELEVATOR IMPORTANCE FACTOR	SDS	HORIZONTAL ACCELERATION EQUIVALENT
PEND	PEND	PEND	PEND



7 RAIL REACTIONS
VT01 SCALE: NTS



Lerch Bates
BUILDING INSIGHT

Global Support Center
9780 S. Meridian Blvd, Suite 450
Englewood, CO 80112
T - 303.795.7956

Project Office

Ohio Office
4995 Bradenton Ave, Suite 200
Dublin, OH 43017
T - 614.648.8961

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT

No.	Description	Date

Sheet Name

GENERAL ELEVATOR
INFORMATION

Issued For:

BID DOCUMENTS

Project Number: 100054344

Governing Codes: ASME A17.1

Date: 09/26/2025

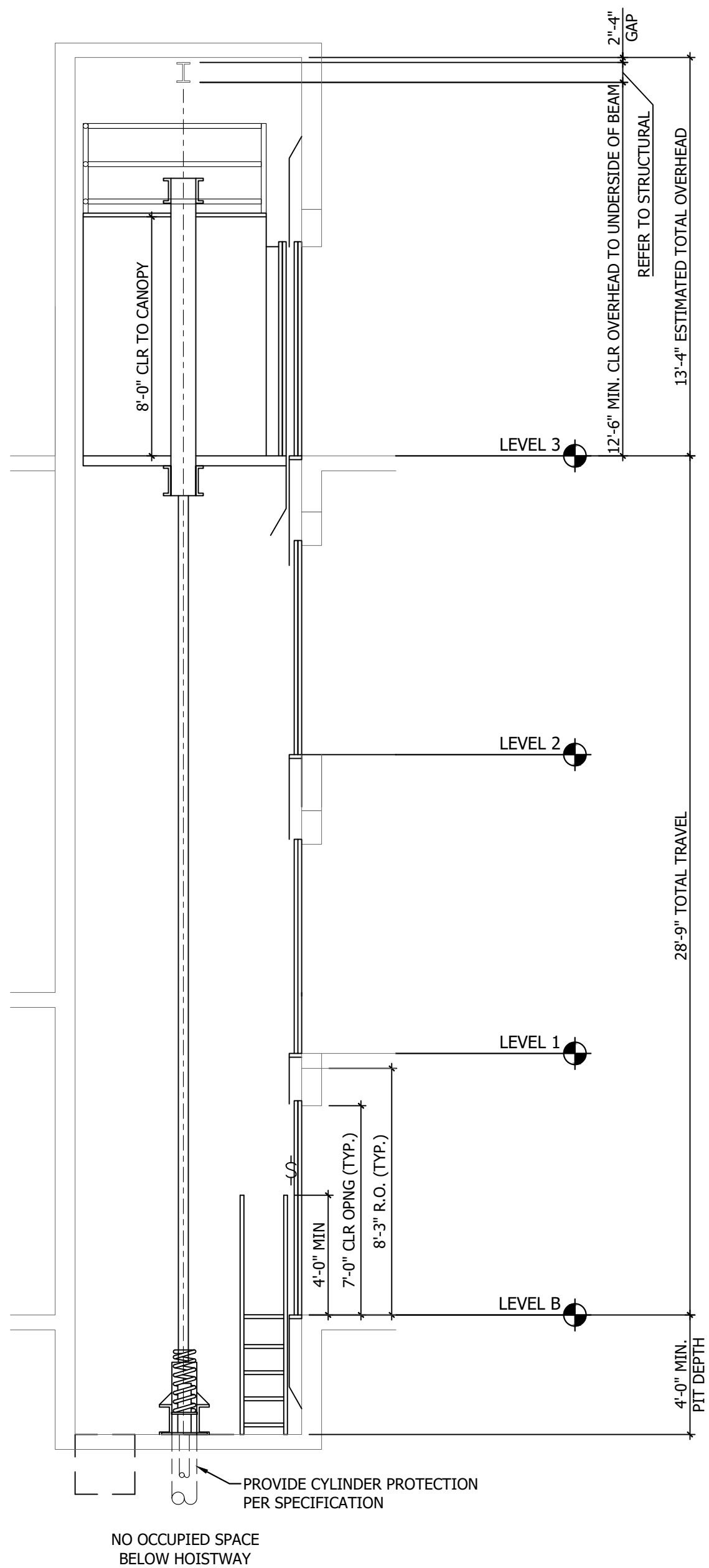
Drawn By: JH

Checked By: LB

Sheet Number: VT01

Scale AS NOTED

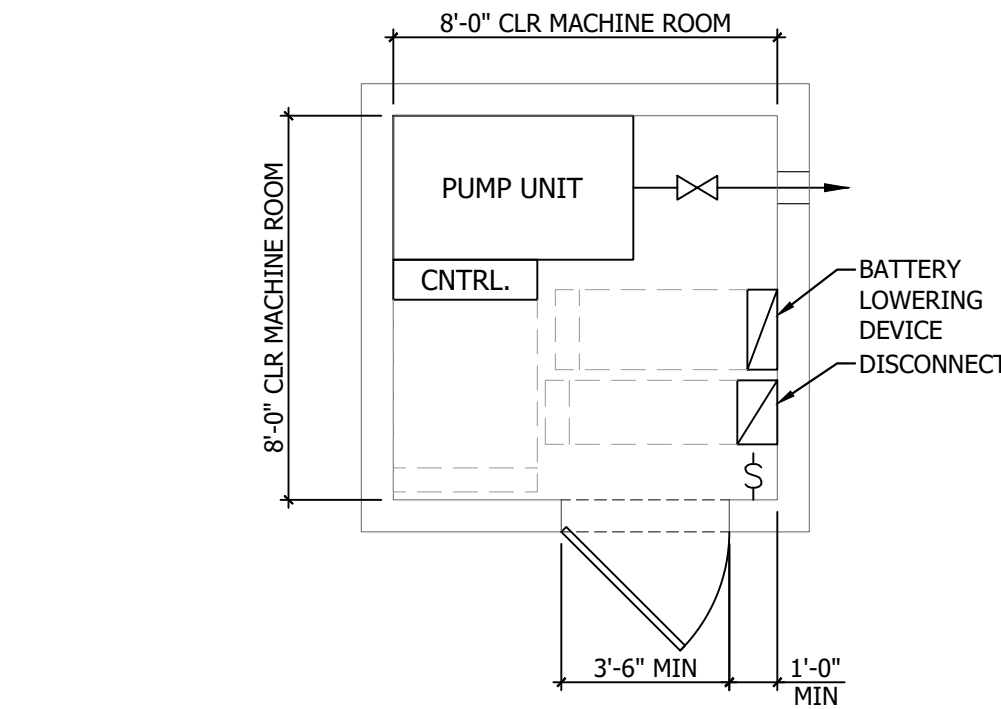
File Name: 380_VT_54344_Sexton High School.dwg



1
VT02

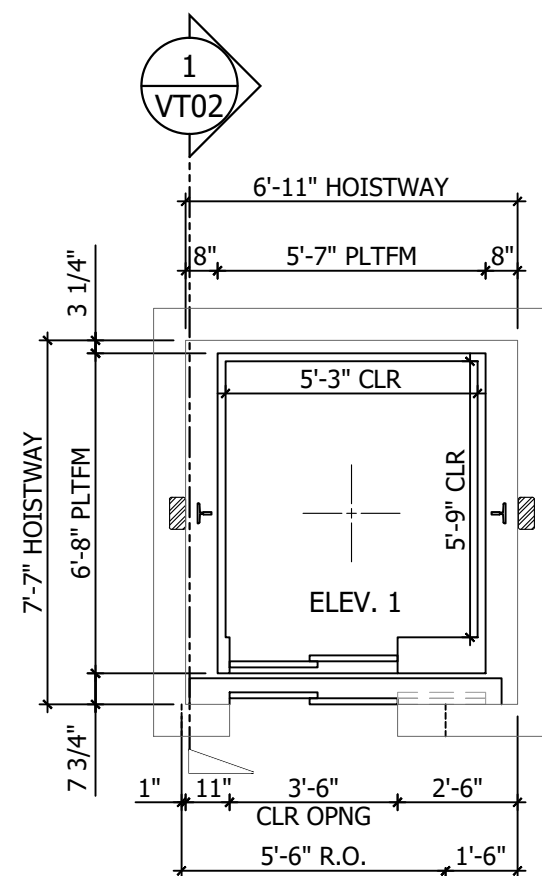
HOISTWAY SECTION - ELEVATOR 1
SCALE: 1/4" = 1'-0"

ELEVATOR 1			
FLOORS SERVED	FLOOR NUMBER	OPENING	FLOOR TRAVEL (FEET)
	3	F	0'-0"
	2	F	10'-0"
	1	F	10'-0"
	B	F	8'-9"
TOTALS	OPENINGS	4	
	STOPS	4	
	TRAVEL		28'-9"



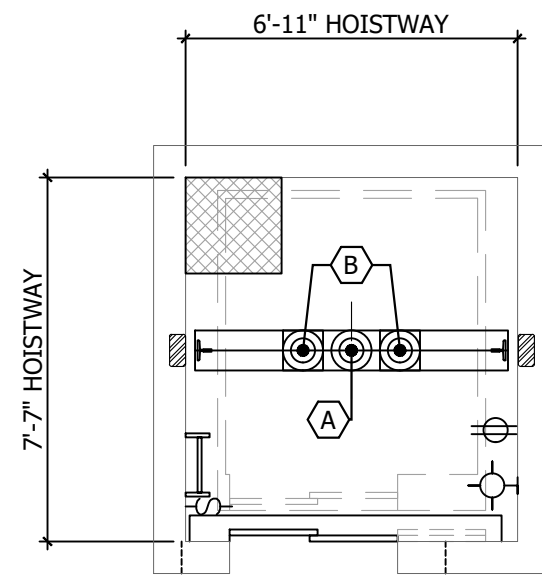
4
VT02

TYPICAL MACHINE ROOM PLAN - ELEVATOR 1
SCALE: 1/4" = 1'-0"



3
VT02

HOISTWAY PLAN - ELEVATOR 1
SCALE: 1/4" = 1'-0"



2
VT02

PIT PLAN - ELEVATOR 1
SCALE: 1/4" = 1'-0"

ELEVATOR NUMBER	DUTY
1	3000# @ 125 FPM - IN-GROUND HYDRAULIC

HOISTWAY NOTES:

1. PROVIDE SMOKE VENTING PER LOCAL CODE REQUIREMENTS.
2. ELEVATOR CONTRACTOR TO PROVIDE 42" (1070mm) HIGH CAR TOP RAILING PER CODE.
3. PROVIDE HOIST BEAM TO SUPPORT 9,200#. VERIFY HOIST BEAM LOCATION AND LOAD REQUIREMENTS WITH ELEVATOR CONTRACTOR.
4. PROVIDE 2 LIFELINE ATTACHMENTS AT THE TOP FRONT OF EACH HOISTWAY. EACH ATTACHMENT SHALL BE CAPABLE OF WITHSTANDING 5000# (2268 kg) LOAD PER OSHA. COORDINATE LOCATION OF ATTACHMENTS WITH ELEVATOR CONTRACTOR.
5. PROVIDE STRUCTURAL SUPPORT FOR CAR GUIDE RAIL FASTENING AT 14'-0" (4270 mm) MAX. VERTICAL SPACING THROUGH TOP OF HOISTWAY. IF THIS SPACING CANNOT BE PROVIDED BY HOISTWAY PERIMETER BEAMS AT EACH FLOOR, AND IF ELEVATOR CONTRACTOR CANNOT PROVIDE BRACKETING FROM TOP AND BOTTOM FLANGE OF HOISTWAY PERIMETER BEAMS TO REDUCE THE SPAN AS NEEDED, PROVIDE INTERMEDIATE SUPPORT BEAMS OR CONTINUOUS VERTICAL STRUCTURE BETWEEN FLOOR BEAMS.
6. ALL VERTICAL DIMENSIONS THAT ARE DIMENSIONED FROM A BUILDING FLOOR ELEVATION ARE DIMENSIONED TO THE FINISH FLOOR ELEVATION.
7. VERTICAL OR ADDITIONAL HORIZONTAL STRUCTURAL SUPPORT FOR RAIL BRACKETING AS REQUIRED FOR CAR BOTH SIDES OF HOISTWAY TO MEET BRACKET SPACING CRITERIA INDICATED IN SECTION.
8. ELEVATOR CONTRACTOR TO PROVIDE CONTINUOUS FASCIA, CAR DOOR INTERLOCKS, OR GENERAL CONTRACTOR TO LOCATE ENTRANCE FACING WALL INTO HOISTWAY 4" (100mm).
9. ADDITIONAL STEEL MAY BE REQUIRED ABOVE HOISTWAY ENTRANCES WITH FLOOR-TO-FLOOR HEIGHTS TALLER THAN 14'-0".
10. PROVIDE MIN. 75° BEVEL GUARD AT ANY LEDGE GREATER THAN 4" (100 mm) AT REAR OR SIDE WALLS OF HOISTWAY (TYP).

MACHINE ROOM NOTES:

1. PROVIDE SELF-CLOSING, SELF-LOCKING MACHINE ROOM ACCESS DOOR.
2. PROVIDE 8" X 8" (200mm X 200mm) BLOCKOUT FOR HYDRAULIC OIL LINE, AND 6" X 6" (150mm X 150mm) BLOCKOUT FOR ELECTRICAL CONDUIT FOR EACH ELEVATOR. VERIFY LOCATION WITH ELEVATOR CONTRACTOR.
3. VERIFY PATH OF OIL LINE WITH ELEVATOR CONTRACTOR. THE MACHINE ROOM AND HOISTWAY SHALL BE LOCATED ON THE SAME SIDE OF AN EXPANSION JOINT.
4. PROVIDE ADEQUATE LIGHTING TO MAINTAIN MIN. 200 LUX (19 FC) ILLUMINATION AT MACHINE ROOM FLOOR.
5. COORDINATE LIGHT FIXTURES AND UTILITY OUTLETS LOCATION WITH ELEVATOR CONTRACTOR.
6. PROVIDE 3-PHASE MAINLINE POWER FEEDER WITH DISCONNECTING MEANS FOR EACH ELEVATOR CONTROLLER. PROVIDE 1-PHASE FEEDER WITH DISCONNECTING MEANS FOR CAR LIGHTING, VENTILATION SYSTEM AND RECEPTACLE FOR EACH ELEVATOR. THESE DISCONNECTING MEANS SHALL INCLUDE OVERCURRENT PROTECTION, SHALL BE LOCATED IN THE MACHINE ROOM, AND SHALL MEET N.E.C. REQUIREMENTS.
7. LOCATE MACHINE ROOM WITHIN 40'-0" OF HOISTWAY.

PIT NOTES:

1. PROVIDE ADEQUATE LIGHTING TO MAINTAIN MIN. 100 LUX (10 FC) ILLUMINATION AT PIT FLOOR.
2. PROVIDE PIT ACCESS LADDER OR DOOR, LIGHT SWITCH, LIGHT, AND GFCI-PROTECTED UTILITY OUTLET.
3. PROVIDE 8" X 8" (200mm X 200mm) BLOCKOUT FOR HYDRAULIC OIL LINE, AND 6" X 6" (150mm X 150mm) BLOCKOUT FOR ELECTRICAL CONDUIT FOR EACH ELEVATOR. VERIFY LOCATION WITH ELEVATOR CONTRACTOR.
4. VERIFY PATH OF OIL LINE WITH ELEVATOR CONTRACTOR.
5. COORDINATE LIGHT FIXTURES AND UTILITY OUTLETS LOCATION WITH ELEVATOR CONTRACTOR.
6. PROVIDE ADEQUATE STRUCTURAL SUPPORT AS REQUIRED FOR BUFFER AND HYDRAULIC CYLINDER REACTIONS.
7. PROVIDE INDIRECT PIT DRAIN OR 24"x24"x24" SUMP PUMP, WITH GRATING COVER, LEVEL WITH PIT FLOOR. PROVIDE MINIMUM SUMP PUMP/DRAIN CAPACITY OF 3,000 GALLONS/HOUR PER ELEVATOR.
8. ELEVATOR CONTRACTOR TO PROVIDE PERMANENT MEANS TO ACCESS UNDERSIDE OF CAR AS REQUIRED.
9. REACTIONS HAVE BEEN DOUBLED FOR IMPACT.
10. REACTIONS DO NOT OCCUR SIMULTANEOUSLY, EXCEPT AS NOTED.

PIT REACTION TABLE			
KEY	REACTION (FORCES IN KIPS)		DESCRIPTION
(A)	21.3		CAR CYLINDER
(B)	12.4	EACH	CAR BUFFER



Lerch Bates
BUILDING INSIGHT

Global Support Center
9780 S. Meridian Blvd, Suite 450
Englewood, CO 80112
T - 303.795.7956

Project Office

Ohio Office
4995 Bradenton Ave, Suite 200
Dublin, OH 43017
T - 614.648.8961

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT

No.	Description	Date

Sheet Name

PLANS AND HOISTWAY
SECTION - ELEVATOR - 1

Issued For: BID DOCUMENTS	
Project Number:	100054344
Governing Codes:	ASME A17.1
Date:	09/26/2025
Drawn By:	JH
Checked By:	LB
Sheet Number:	VT02
Scale	1/4" = 1'-0"

PLUMBING ABBREVIATIONS

AD	AREA DRAIN	NTS	NOT TO SCALE
ASR	AUTOMATIC SPRINKLER RISER	ORD	OVERFLOW ROOF DRAIN
BFS	BELOW FLOOR SLAB	OXY	OXYGEN
BWV	BACK WATER VALVE	P	PUMP
CB	CATCH BASIN	PD	PRESSURE DROP
CI	CAST IRON	PVC	POLY-VINYL-CHLORIDE
CO	CLEAN OUT	RC	RAIN CONDUCTOR
CV	CONTROL VALVE	RI	ROOF DRAIN
DF	DRINKING FOUNTAIN	ROUGH-IN	ROUGH-IN
DIA	DIAMETER	REQD	REQUIRED
DN	DOWN	SAN	SANITARY
DWH	DOMESTIC WATER HEATER	SHWR	SHOWER
E.T.C.	ELECTRICAL TRADES CONTRACTOR	SK	SINK
EWC	ELECTRIC WATER COOLER	SP	STAND PIPE
EXIST	EXISTING	SQ. FT.	SQUARE FEET
FD	FLOOR DRAIN	SS	SERVICE SINK
FC	FINAL CONNECTIONS	ST	STORM
FDC	FIRE DEPT. CONNECTION	S&W	STOP & WASTE
FF	FINISH FLOOR	STR	STRAINER
FHV	FIRE HOSE VALVE	SV	STACKED VENT
FT	FEET	TYP.	TYPICAL
GAL	GALLON	URNAL	URNAL
GD	GARBAGE DISPOSAL	VB	VACUUM BREAKER
GI	GREASE INTERCEPTOR	V.F.A.	VARIABLE FREQUENCY DRIVE
GPH	GALLONS PER HOUR	VS	VENT STACK
GPM	GALLONS PER MINUTE	VTR	VENT THRU ROOF
HB	HOSE BIB	W	WASTE
HD	HEAD (FT)	WB	WET BULB
HP	HORSE POWER	WC	WATER CLOSET
ID	INSIDE DIAMETER	WH	WALL HYDRANT
I.E.	INVERT ELEVATION	WS	WASTE STACK
LAV	LAVATORY	W&V	WASTE AND VENT
LT	LAUNDRY TRAY	X-CW	EXIST. CW PIPING ITEM
MA	MEDICAL AIR		
MAX	MAXIMUM		
MGC	MEDICAL GAS CONSOLE		
MH	MAN HOLE		
MIN	MINIMUM		
MS	MOP SINK		
M.T.C.	MECHANICAL TRADES CONTRACTOR		

GENERAL PLUMBING NOTES

- ALL PLUMBING WORK SHALL CONFORM TO MICHIGAN PLUMBING CODE, LATEST APPLICABLE EDITION.
- ALL PIPE SIZES SHOWN ARE SERVICE SIZE. SIZE SLEEVES FOR 1" CLEAR SPACE BETWEEN PIPE AND SLEEVE FOR INSTALLATION OF MECHANICAL SEAL.
- CONTRACTOR SHALL DEMOLISH & REMOVE EXISTING PIPING, FITTINGS, & EQUIPMENT AS REQUIRED FOR NEW INSTALLATIONS. VALVE & CAP PIPING TO REMAIN.
- FIELD VERIFY LOCATIONS OF EXISTING PIPING THAT MAY CONFLICT WITH NEW CONSTRUCTION AND RELOCATE AS NEEDED.
- NOTIFY OWNER OF ANY PIPING DEMOLITION THAT MAY AFFECT NORMAL OPERATION OF OTHER AREAS.
- 1% SLOPE FOR ALL SANITARY PIPING.
- THE CONTRACTOR SHALL FIELD VERIFY THE SIZES, LOCATION, ELEVATIONS, AND DETAILS OF ALL EXISTING CONDITIONS THAT MAY AFFECT THE WORK.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE INTEGRITY OF ALL EQUIPMENT AND MATERIALS IN A "NEW" CONDITION DURING CONSTRUCTION.
- ALL WORK SHALL BE PERFORMED BY LICENSED CONTRACTORS AND SUBCONTRACTORS AS REQUIRED BY LAW.
- DESIGN AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CODES AND REGULATIONS ENFORCED BY LOCAL BUILDING OFFICIALS.
- IF THERE IS CONFLICTING INFORMATION IN THE PLANS OR SPECIFICATIONS THE MORE STRINGENT AND GREATER COST ITEM SHALL BE USED.
- DRAWINGS INDICATE REQUIRED SIZES AND POINTS OF TERMINATION OF PIPES AND SUGGESTED ROUTES. IT IS NOT INTENTION OF DRAWINGS TO INDICATE ALL NECESSARY OFFSETS. INSTALL WORK IN MANNER TO CONFORM TO STRUCTURE, AVOID OBSTRUCTIONS, PRESERVE HEADROOM AND KEEP OPENINGS AND PASSAGEWAYS CLEAR. DO NOT SCALE FROM DRAWINGS.

SUMP PUMP SCHEDULE

TAG	MODEL	TYPE	GPM	FT. HEAD	DISCHARGE		BASIN			ELECTRICAL				REMARKS
					PIPE	SOLID	TYPE	SIZE	DEPTH	HP	VOLTS	PHASE	RPM	
SP-1	1456	SUBMERSIBLE SIMPLEX	50	25	2"	0.5"	CONCRETE	18"x24"	24"	1/2	115	1	1750	1, 2, 3, 4
NOTES: 1. BASED ON: WEIL 2. PROVIDE 1" GRATE STYLE BASIN COVER 3. PROVIDE CONTROL PANEL W/ INTERNAL DISCONNECT & STARTER 4. PROVIDE LEVEL CONTROL SYSTEM ABBREVIATIONS: PCC = PRE-CAST CONCRETE														

OIL INTERCEPTOR SCHEDULE

TAG	MODEL	LOCATION	OIL HOLDING CAPACITY (GALLONS)	LIQUID HOLDING CAPACITY (GALLONS)	GPM	INLET/ OUTLET	DIMENSIONS			COMMENTS
							WIDTH	DEPTH	HEIGHT	
OI-1	OI-XL-100	LOWER LEVEL	172	300	100	4	33.5"	83"	62.5"	1,2,3
NOTES: 1. BASED ON TOWN & COUNTRY PLASTICS (T&C) 2. HDPE ROTATIONAL MOLDED 3. LOCATED IN LOWER LEVEL ON FLOOR										

PLUMBING SYMBOLS LEGEND

PLUMBING PIPING

— CW —	COLD WATER
— CW —	COLD WATER BELOW FINISH SLAB
— HW —	HOT WATER
— HW —	HOT WATER BELOW FINISH SLAB
— HWR —	HOT WATER RETURN
— HWR —	HOT WATER RETURN BELOW FINISH SLAB
— SW —	SOFTENED WATER
— SW —	SOFTENED WATER BELOW FINISH SLAB
— SWR —	SOFTENED WATER RETURN
— SWR —	SOFTENED WATER RETURN BELOW FINISH SLAB
— TW —	TEMPERED WATER
— TW —	TEMPERED WATER BELOW FINISH SLAB
— TWR —	TEMPERED WATER RETURN
— TWR —	TEMPERED WATER RETURN BELOW FINISH SLAB
— DI —	DEIONIZED WATER
— DI —	DEIONIZED WATER BELOW FINISH SLAB
— RO —	REVERSE OSMOSIS WATER
— RO —	REVERSE OSMOSIS WATER RETURN BELOW FINISH SLAB
— FP —	FIRE PROTECTION
— G —	GAS (NATURAL)
— LP —	GAS (LIQUID PETROLEUM)
— ARV —	ACID RESISTANT
— ARW —	VENT ACID RESISTANT WASTE
— ARW —	ACID RESISTANT WASTE BELOW FINISH SLAB
— RC —	RAIN CONDUCTOR
— ST —	STORM BELOW FINISH SLAB
— ORC —	OVERFLOW RAIN CONDUCTOR
— ORC —	OVERFLOW RAIN CONDUCTOR BELOW FINISH SLAB
— SAN —	SANITARY WASTE
— SAN —	SANITARY WASTE BELOW FINISH SLAB
— V —	VENT PIPING
— V —	VENT PIPING BELOW FINISH SLAB
— CA —	COMPRESSED AIR
— O2 —	OXYGEN
— NO —	NITROUS OXIDE
— N2 —	NITROGEN
— MA —	MEDICAL AIR
— VAC —	VACUUM
— —	DEMOLITION

PLUMBING VALVES

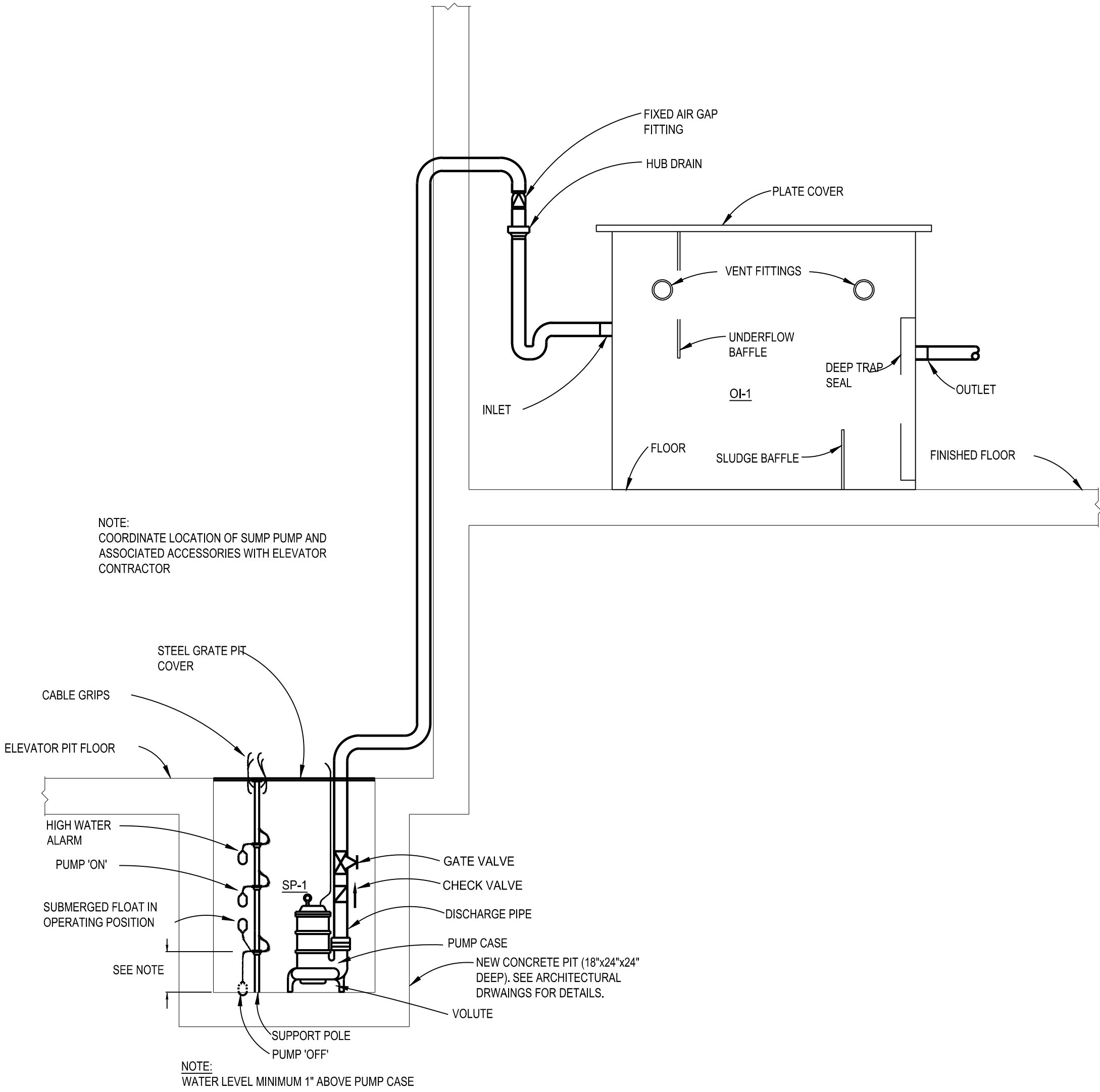
— — —	GATE VALVE
— — —	GAS COCK
— — —	CHECK VALVE
— — —	BALANCE COCK
— — —	CIRCUIT SETTER
— — —	TWO-WAY CONTROL VALVE
— — —	THREE-WAY CONTROL VALVE
— — —	GLOBE VALVE
— — —	BALL VALVE
— — —	OS&Y VALVE
— — —	SOLENOID VALVE
— — —	EXPANSION VALVE WITH THERMOSTATIC BULB
— — —	PLUG VALVE
— — —	BUTTERFLY VALVE
— — —	RELIEF VALVE
— — —	HOSE & DRAIN END VALVE
— — —	PRESSURE RELIEF VALVE
— — —	PRESSURE REDUCING VALVE
— — —	TRIPLE DUTY VALVE
— — —	GAS PRESSURE REGULATOR
— — —	STRAINER (BLOW-OFF)

MISCELLANEOUS NOTES

●	POINT OF CONNECTION BETWEEN NEW AND EXISTING
◆	POINT OF EXISTING TO REMAIN AND EXISTING TO BE REMOVED
(X)	INDICATES PLAN NOTE
(X)	INDICATES DEMOLITION NOTE
XX	DETAIL BUBBLE
XXXX	DETAIL NUMBER
XXXX	PAGE LOCATION INDICATES
— — —	DIRECTION OF DETAIL SECTION

PLUMBING EQUIPMENT

— — —	FLOW DIRECTION
— — —	PIPING DROP
— — —	PIPING RISE
— — —	FLOOR CLEANOUT
— — —	INLINE PIPING DROP
— — —	INLINE PIPING RISE
— — —	PIPING TEE
— — —	PIPING ELBOW
— — —	INLINE CLEANOUT
— — —	PLUMBING TRAP
— — —	THERMOMETER
— — —	CONNECTION
— — —	PUMP
— — —	UNION
— — —	PIPE ANCHOR
— — —	PIPE GUIDE
— — —	FLOOR DRAIN & FLOOR SINK
— — —	BACK FLOW PREVENTER
— — —	FLANGE END CONNECTION
— — —	WALL HYDRANT & HOSE BIBB
— — —	REGULAR & OVERFLOW ROOF DRAIN
— — —	PIPE CAP
— — —	PIPE BREAK
— — —	WATER METER
— — —	GAS METER
— — —	PRESSURE GAUGE
— — —	FIRE HYDRANT
— — —	SPRINKLER HEAD (PENDANT)
— — —	SPRINKLER HEAD (UPRIGHT)
— — —	SPRINKLER HEAD (SIDEWALL)
— — —	FIRE DEPARTMENT CONNECTION
— — —	PIPING FLEXIBLE CONNECTOR
— — —	SIGHT GLASS
— — —	PIPE EXPANSION
— — —	COMPENSATOR FLOW SENSOR DEVICE
— — —	FLOW METER
— — —	FLOW SWITCH
— — —	PRESSURE SWITCH
— — —	SUPERVISORY SWITCH INVERTED
— — —	BUCKET TRAP
— — —	FLOAT & THERMOSTATIC TRAP



ELEVATOR SUMP PUMP AND OIL INTERCEPTOR DETAIL

SCALE: NTS

REVISIONS

9/26/2025	ISSUED FOR BIDS AND PERMITS		
-----------	-----------------------------	--	--

DRAWN

TRB

APPROVED

BRH

MATRIX
CONSULTING ENGINEERS, INC.

544 Chebourg Drive
Lansing, MI 48917
PHONE (313) 487-2511
administrator@matrixinc.com
Fax: (313) 487-2511

PROJECT

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID 50-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION

PLUMBING
SYMBOLS
ABBREV.
+ NOTES

DATE

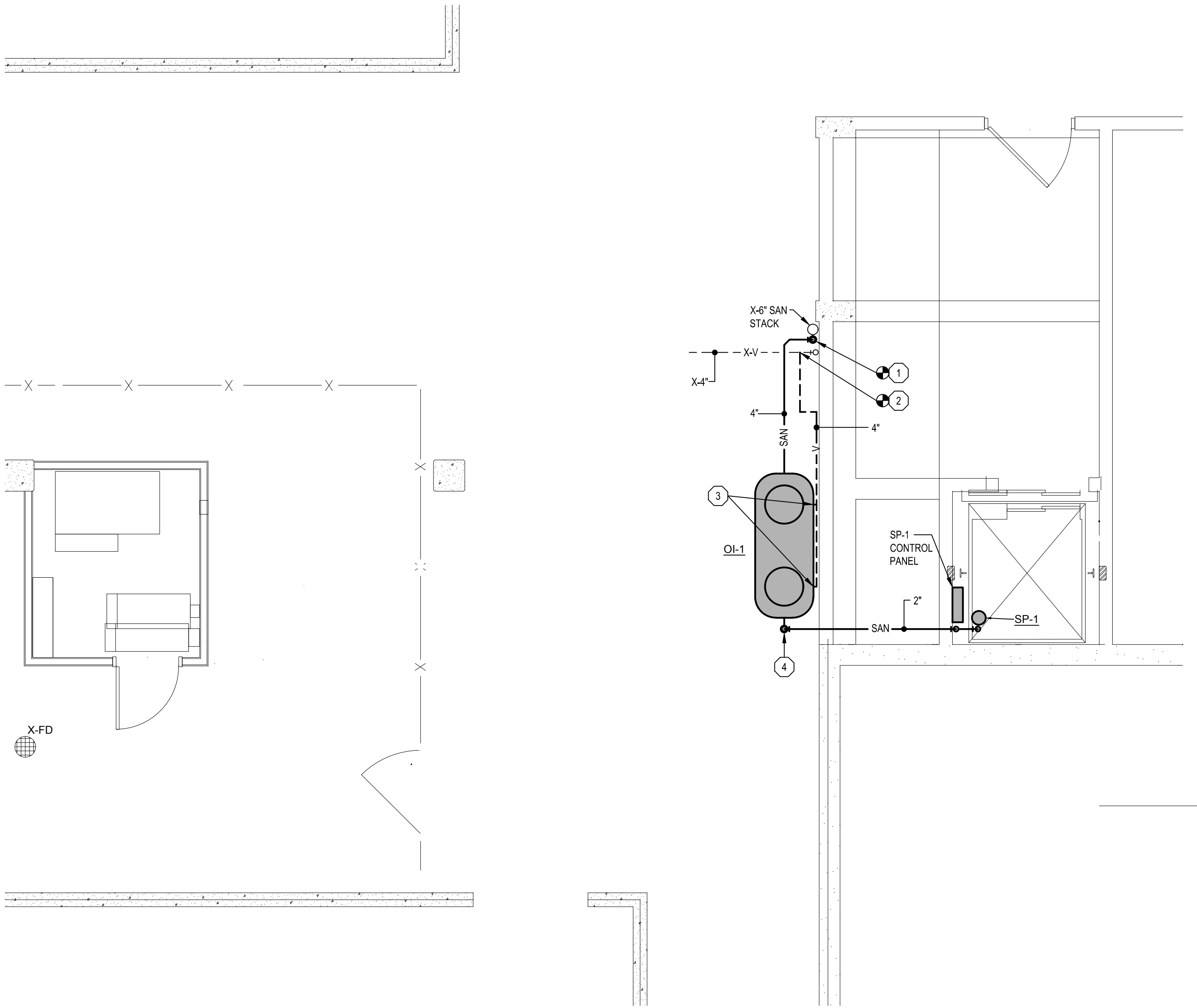
03/24/25

PROJECT NUMBER

24448.00

SHEET NUMBER

P-100



**PARTIAL LOWER LEVEL FLOOR PLAN
PLUMBING NEW**

0 5 10
SCALE: 1/4" = 1'-0"

PLUMBING KEY NOTES

- 1 CONNECT 4" SAN FROM OL-1 TO CAPPED X-SAN "Y" FITTING ON X-6" SAN STACK AT FLOOR.
- 2 CONNECT 4" VENT TO X-4" VENT.
- 3 CONNECT 3" V TO OL-1 VENT PORT.
- 4 AIR GAP. SEE DETAIL #1 ON SHEET P-100.

REVISIONS	
03/26/2025 ISSUED FOR BIDS AND PERMITS	

DRAWN
TRB
APPROVED
BRH

**MATRIX**
CONSULTING ENGINEERS, INC

544 Cheabourge Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Main Project No. 24448.00

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION

**PARTIAL
LOWER LEVEL
PLUMBING FLOOR
PLAN NEW**

DATE

03/24/25

PROJECT NUMBER

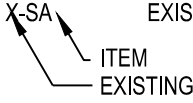
24448.00

SHEET NUMBER

P-400

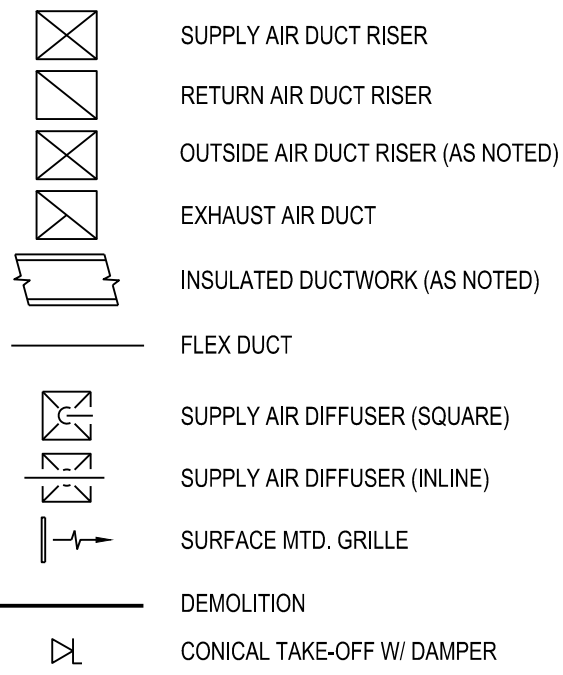
MECHANICAL ABBREVIATIONS

AFF	ABOVE FINISH FLOOR
A.T.C.	ARCHITECTURAL TRADES CONTRACTOR
B.A.S.	BUILDING AUTOMATION SYSTEM
CFM	CUBIC FEET PER MINUTE
CONV	CONVECTOR
DN	DOWN
EG	EXHAUST GRILLE
E.T.C.	ELECTRICAL TRADES CONTRACTOR
EXH	EXHAUST
EXIST	EXISTING
FF	FINISH FLOOR
GR	GRILLE
HVAC	HEATING, VENTILATION, & AIR CONDITIONING
MAX	MAXIMUM
MBH	BTU PER HOUR (THOUSAND)
MIN	MINIMUM
M.T.C.	MECHANICAL TRADES CONTRACTOR
N.C.	NOISE CRITERIA
NTS	NOT TO SCALE
	EXISTING ITEM (EXISTING SUPPLY AIR DUCT)



MECHANICAL SYMBOLS LEGEND

HVAC DUCTWORK SYMBOLS



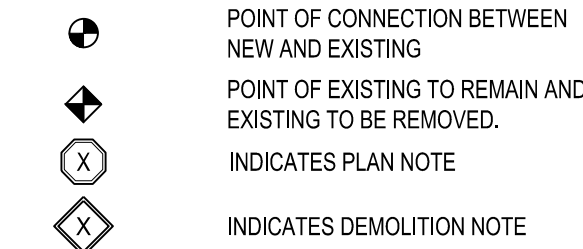
HVAC DUCTWORK

— SA —	SUPPLY AIR DUCT
— X-SA —	EXIST SUPPLY AIR DUCT
— RA —	RETURN AIR DUCT
— X-RA —	EXIST RETURN AIR DUCT
— OA —	OUTSIDE AIR DUCT
— X-OA —	EXIST OUTSIDE AIR DUCT
— EA —	EXHAUST AIR DUCT
— X-EA —	EXIST EXHAUST AIR DUCT

HVAC DUCTWORK & DIFFUSER TAGS

SD-1	250	TAG	CFM
8'-6"	TYP. 4	NECK	REMARKS
		SIZE	

MISCELLANEOUS NOTES



TEMPERATURE CONTROL SYMBOLS



GENERAL HVAC NOTES

- NOTIFY OWNER OF ANY PIPING OR DUCTWORK DEMOLITION THAT MAY AFFECT NORMAL OPERATION OF OTHER AREAS.
- FIELD VERIFY LOCATIONS OF EXISTING PIPING THAT MAY CONFLICT WITH NEW CONSTRUCTION AND RELOCATE AS NEEDED.
- CONTRACTOR SHALL COORDINATE ALL WORK WITH OTHER DISCIPLINES PRIOR TO CONSTRUCTION TO AVOID CONFLICTS.
- THE CONTRACTOR SHALL FIELD VERIFY THE SIZES, LOCATION, ELEVATIONS, AND DETAILS OF ALL EXISTING CONDITIONS THAT MAY AFFECT THE WORK.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE INTEGRITY OF ALL EQUIPMENT AND MATERIALS IN A "NEW" CONDITION DURING CONSTRUCTION.
- ALL WORK SHALL BE PERFORMED BY LICENSED CONTRACTORS AND SUBCONTRACTORS AS REQUIRED BY LAW.
- ALL WORK SHALL CONFORM TO MICHIGAN MECHANICAL CODE, LATEST APPLICABLE EDITION.
- IF THERE IS CONFLICTING INFORMATION IN THE PLANS OR SPECIFICATIONS THE MORE STRINGENT AND GREATER COST ITEM SHALL BE USED.
- DRAWINGS INDICATE REQUIRED SIZES AND POINTS OF TERMINATION OF PIPES AND DUCTS AND SUGGESTED ROUTES. IT IS NOT INTENTION OF DRAWINGS TO INDICATE ALL NECESSARY OFFSETS. INSTALL WORK IN MANNER TO CONFORM TO STRUCTURE, AVOID OBSTRUCTIONS, PRESERVE HEADROOM AND KEEP OPENINGS AND PASSAGEWAYS CLEAR. DO NOT SCALE FROM DRAWINGS.
- CONTRACTOR TO REMOVE AND REINSTALL CEILING TILES AND CEILING GRID AS NEEDED TO COMPLETE THEIR WORK.

MECHANICAL SPECIFICATIONS

- ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH ALL APPLICABLE CODES, SPECIFICATIONS, LOCAL ORDINANCES, INDUSTRY STANDARDS UTILITY COMPANY REGULATIONS, MANUFACTURER'S INSTALLATION INSTRUCTIONS.

DRAWINGS

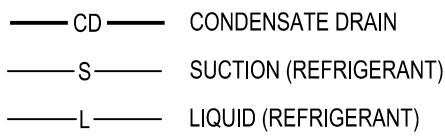
- MECHANICAL DRAWINGS SHOW GENERAL ARRANGEMENT OF ALL PIPING EQUIPMENT AND APPURTENANCES. THEY SHALL BE FOLLOWED AS CLOSELY AS ACTUAL BUILDING CONSTRUCTION AND WORK OF OTHER TRADES WILL PERMIT.
- MECHANICAL WORK SHALL CONFORM TO REQUIREMENTS SHOWN ON ALL DRAWINGS. GENERAL AND STRUCTURAL DRAWINGS SHALL TAKE PRECEDENCE OVER MECHANICAL DRAWINGS.
- BECAUSE OF SMALL SCALE OF MECHANICAL DRAWINGS IT IS NOT POSSIBLE TO INDICATE ALL OFFSETS, FITTINGS AND ACCESSORIES WHICH MAY BE REQUIRED. CONTRACTOR SHALL INVESTIGATE STRUCTURAL AND FINISH CONDITIONS AFFECTING WORK AND SHALL ARRANGE HIS WORK ACCORDINGLY, PROVIDING SUCH FITTINGS, VALVES AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS.

MINOR DEVIATIONS

- FOR PURPOSE OF CLARITY AND LEGIBILITY, DRAWINGS ARE ESSENTIALLY DIAGRAMMATIC ALTHOUGH SIZE AND LOCATION OF EQUIPMENT AND PIPING ARE DRAWN TO SCALE WHEREVER POSSIBLE. VERIFY CONTRACT DOCUMENT INFORMATION AT SITE.
- DRAWINGS INDICATE REQUIRED SIZES AND POINTS OF TERMINATION OF PIPES AND DUCTS AND SUGGESTED ROUTES. IT IS NOT INTENTION OF DRAWINGS TO INDICATE ALL NECESSARY OFFSETS. INSTALL WORK IN MANNER TO CONFORM TO STRUCTURE, AVOID OBSTRUCTIONS, PRESERVE HEADROOM AND KEEP OPENINGS AND PASSAGEWAYS CLEAR. DO NOT SCALE FROM DRAWINGS.

MECHANICAL SYMBOLS LEGEND

HVAC PIPING



TEMPERATURE CONTROL SYMBOLS



SPLIT SYSTEM AIR CONDITIONING UNIT SCHEDULE

LOCATIONS			INDOOR UNIT										CONDENSING UNIT						COMMENTS	
TAG	INDOOR UNIT	COND. UNIT	TAG	MODEL	COOLING MBH	TONS	HEATING MBH	CFM	VOLTAGE	PHASE	FLA	MCA	TAG	MODEL	MBH	VOLTAGE	PHASE	FLA		MCA
AC-1/CU-1	LOWER LEVEL	ENTRY ROOF	AC-1	PKA-ASK30NL	30	2.5	34	775	208/230	1	0.58	1	CU-1	PUZ-AK30NLHZ	30	208/230	1	23	29	1,2,3,4,5,6,7,8
NOTES: 1. BASED ON MITSUBISHI ELECTRIC 2. COOLING DESIGN BASED ON 80°F DB AND 67°F WB, 50% RH 3. HEATING DESIGN BASED ON 70°F DB AND 60°F WB, OUTDOOR 47°F DB 4. R454B REFRIGERANT 5. ELECTRICAL CONTRACTOR SHALL PROVIDE DISCONNECT SWITCH FOR CONDENSING UNIT 6. BACNET BAS CARD 7. PROGRAMMABLE THERMOSTAT BY MANUFACTURER 8. PROVIDE 12" HIGH CONDENSING UNIT STAND																				

REVISIONS			
9/28/2025	ISSUED FOR BIDS AND PERMITS		

DRAWN

TRB

APPROVED

BRH

MATRIX
CONSULTING ENGINEERS, INC.

544 Chertburg Drive
Lansing, MI 48917
PHONE: (313) 487-2511
administrator@matrixceinc.com
Matrix Project No. 24448.00

PROJECT

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION

MECHANICAL
SYMBOLS
ABBREVIATIONS
+ NOTES

DATE

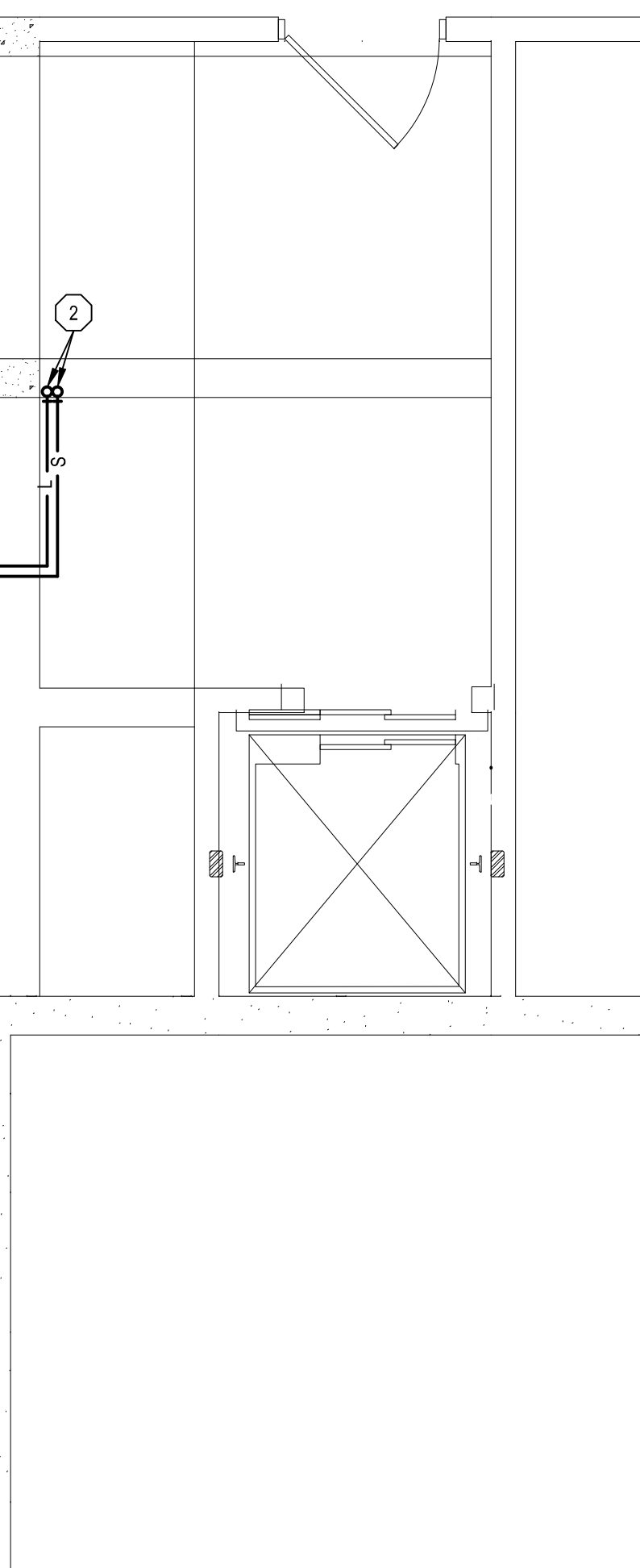
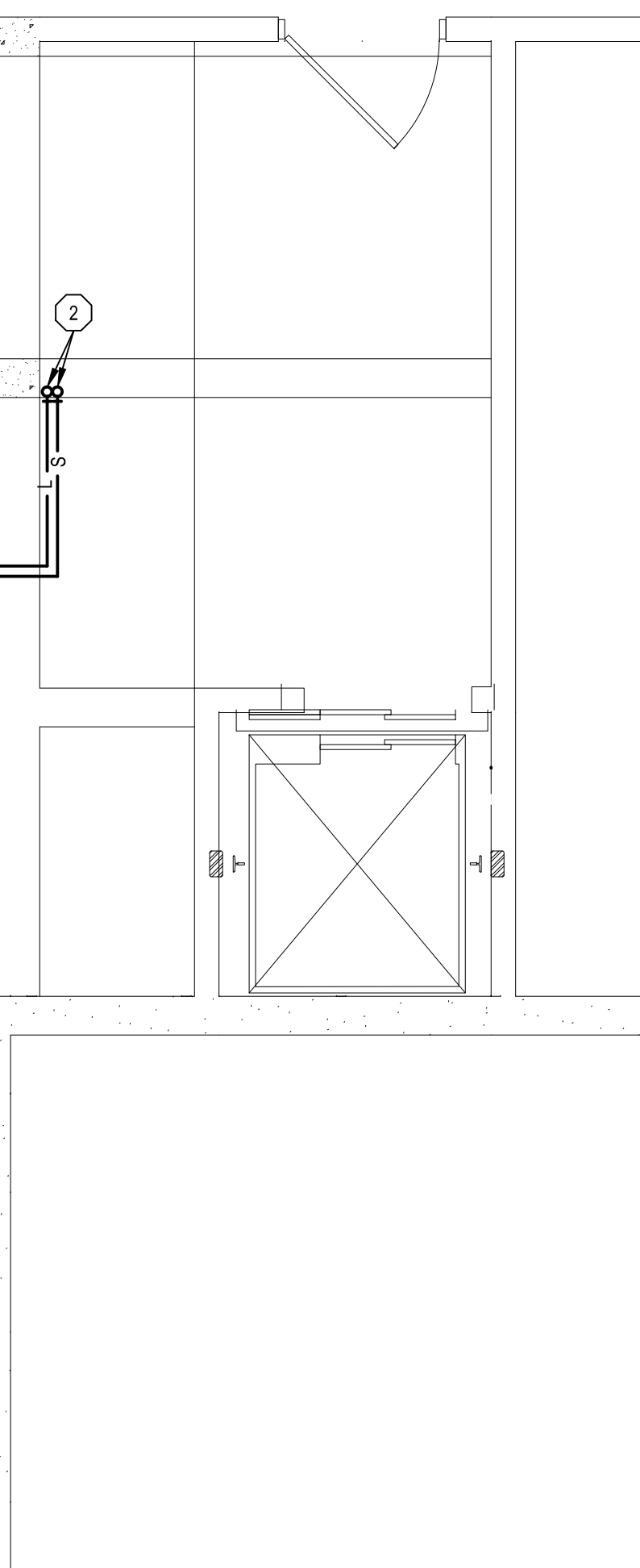
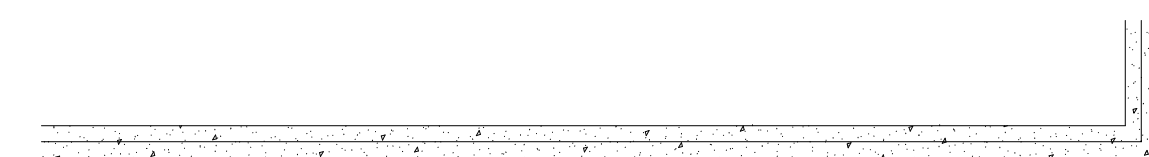
03/24/25

PROJECT NUMBER

24448.00

SHEET NUMBER

M-100



- 1 RUN 3/4" CD ACROSS FLOOR TO X-FD. DISCHARGE WITH AIR GAP.
- 2 3/8" L 5/8" S UP TO FIRST FLOOR.
- 3 3/8" L 5/8" S DOWN TO LOWER LEVEL.
- 4 CORE, SLEEVE, AND SEAL WALL AROUND REFRIGERANT PIPING.
- 5 3/8" L 5/8" S UP TO SECOND FLOOR.
- 6 3/8" L 5/8" S DOWN TO FIRST FLOOR.
- 7 PROVIDE 0.015" PEBBLE EMBOSSED JACKET ON ALL EXTERIOR REFRIGERANT PIPING.
- 8 12" HIGH CONDENSOR MOUNTING BASE.
- 9 NEW GUARDRAIL. SEE ARCHITECTURAL PLANS FOR DETAILS.

REVISIONS				

9/26/2025	ISSUED FOR BIDS AND PERMITS
-----------	-----------------------------

DRAWN

TRB

APPROVED

BRH

MATRIX
CONSULTING ENGINEERS, INC.

544 Chenbourg Drive
Lansing, MI 48917
PHONE: (517) 467-2511
administrator@matrixinc.com
Matrix Project No. 2446600

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION	
PARTIAL HVAC FLOOR PLANS NEW	
DATE	
03/24/25	
PROJECT NUMBER	
24448.00	
SHEET NUMBER	
M-400	

ELECTRICAL SYMBOLS LEGEND

OUTLETS	FIXTURES	SERVICE AND EQUIPMENT
SINGLE RECEPTACLE (120 VOLT)	LIGHT FIXTURE	TRANSIENT VOLTAGE SURGE SUPPRESSION
DUPLEX RECEPTACLE	STRIP FIXTURE	VARIABLE FREQUENCY DRIVE
EMERGENCY RECEPTACLE	EMERGENCY LIGHT FIXTURE	TRANSFORMER
DOUBLE DUPLEX RECEPTACLE	IN-GRADE LIGHT FIXTURE	FUSED DISCONNECT SWITCH
FLUSH FLOOR BOX	SPOTLIGHT (number of heads shown)	MAGNETIC STARTER
SURFACE FLOOR BOX	EXIT SIGN (face & direction as shown)	COMB. STARTER
SPECIAL EQUIPMENT RECEPTACLE	WALL MOUNT LIGHT FIXTURE	PANELBOARD, SURFACE MOUNTED
TELEPHONE OUTLET	CEILING LIGHT FIXTURE	PANELBOARD, FLUSH MOUNTED
DATA OUTLET	TRACK & FIXTURE	WEATHERHEAD
TELEPHONE / DATA OUTLET	STREET TYPE POLE FIXTURE	UTILITY METER, AS REQUIRED
POWER POLE	POLE MOUNTED LIGHT FIXTURE	DIGITAL EQUIPMENT METER, AS REQUIRED
JUNCTION BOX	EXTERIOR WALL MOUNT LIGHT FIXTURE	CURRENT TRANSFORMERS
WALL JUNCTION BOX	WALLPACK LIGHT FIXTURE	GENERATOR, KW SHOWN
PULL (JUNCTION) BOX	SPECIAL PURPOSE LIGHT FIXTURE	TELEPHONE TERMINAL BOARD
UNDERFLOOR JUNCTION BOX	HIGH BAY LIGHT FIXTURE	GROUND CONNECTION PER N.E.C.
CEILING MOUNTED WIFI	EMERGENCY EGRESS LIGHT FIXTURE (number of heads shown)	WIREWAY
	DOCK LIGHT FIXTURE	TRANSFER SWITCH
SWITCHES	CIRCUITRY and RACEWAYS	ENCLOSED CIRCUIT BREAKER
SINGLE-POLE SWITCH	CONDUIT INSTALLED (by E.C.)	CAPACITOR
THREE-WAY SWITCH	CONDUIT INSTALLED (by others)	CONTROL
FOUR-WAY SWITCH	CONDUIT STUB UP	THERMOSTAT
SWITCH WITH PILOT LIGHT	CONDUIT STUB DOWN	HUMIDISTAT
THERMAL OVERLOAD SWITCH	HOME RUN (with circuit numbers)	PHOTOCELL (voltage as required)
MANUAL MOTOR SWITCH	END OF CONDUIT RUN	TIME CLOCK (24 hour U.O.N.)
KEY SWITCH	END OF CONDUIT RUN, CAP AND STAKE	PUSHBUTTON STATION (number of buttons indicated)
TIME SWITCH	"CONDUIT RUN CONTINUES" INDICATION	CONTROL TRANSFORMER
DIMMER SWITCH	FLEXIBLE PIGTAILS/CONNECTIONS	LIGHTING CONTACTOR
MECHANICAL	WIREMOLD AS SPECIFIED	IRRIGATION CONTROLLER (120 volt xVxA connection by x/C)
SINGLE PHASE MOTOR	PLUGMOLD AS SPECIFIED	
THREE PHASE MOTOR	BUS DUCT	
RESISTANCE HEATER, KW SHOWN	UNDERFLOOR DUCT	
PIPE TRACE HEATER		
ELECTRIC UNIT HEATER	SOUND and SIGNAL	WALL MOUNT DUAL TECHNOLOGY SENSOR
ELECTRIC WATER HEATER	SPEAKER	OCCUPANCY SENSOR / PHOTOCELL
NURSE CALL	WALL MOUNTED SPEAKER	ULTRASONIC SENSOR - 360° - 2 CIRCUIT
NURSE CALL CONTROLLER	WALL MOUNTED SPEAKER / CLOCK COMBO	DUAL TECHNOLOGY SENSOR - 360° - 1000 SQ
MASTER STATION	SINGLE FACE CLOCK	DUAL TECHNOLOGY SENSOR - 360° - 500 SQ
EMERGENCY PULL STATION	DUAL FACE CLOCK	SWITCH STYLE OCCUPANCY SENSOR
EMERGENCY PUSH STATION	VIDEO INPUT	POWER PACK
CODE BLUE STATION	AUDIO / VIDEO INPUT	
PENDENT INTERFACE	BELL	
BED / LIGHT INTERFACE	VOLUME CONTROL	
SINGLE BED STATION	BUZZER	
DUAL BED STATION	CHIME	
DOME LIGHT	TELEVISION OUTLET	
STAFF REGISTER STATION	MICROPHONE OUTLET	
STAFF STATION	INTERCOM OUTLET	DIGITAL TIME SWITCH
DUTY STATION	CAMERA	FIRE ALARM
DESIGNATIONS	DOOR CONTACT	SMOKE DETECTOR
DEMOLITION NOTE	MOTION DETECTOR	HEAT DETECTOR
PLAN NOTE	BEAM DETECTOR	DUCT SMOKE DETECTOR
ADDENDUM NOTE	KEY PAD	DUCT SMOKE DETECTOR
	SECURITY SYSTEM CONTROL PANEL	HORN
	CCTV CONTROL PANEL	HORN & LIGHT
	CARD READER	SPEAKER
	STUDENT STATION	SPEAKER & LIGHT
	ADMINISTRATION STATION	PULL STATION
	TEACHER STATION	FIRE ALARM CONTROL PANEL
	GLASS BREAK	ANNUNCIATOR PANEL
		END OF LINE DEVICE
		REMOTE INDICATING LIGHT, WALL MTD.
		REMOTE INDICATING LIGHT, CLG. MTD.
		MAGNETIC DOOR HOLDER
		FIREFIGHTER COMMUNICATION JACK
		FLOW SWITCH (furnished by FP/C)
		TAMPER SWITCH (furnished by FP/C)
		VISUAL ONLY UNIT
		FIRE CONTROL POWER SUPPLY
		MONITOR MODULE
		CONTROL MODULE
		CARBON MONOXIDE DETECTOR

ABBREVIATIONS LEGEND

AC	AMPS	GC	GENERAL CONTRACTOR	P	POLE
ACU-	ABOVE COUNTER	GFI	GROUND FAULT INTERRUPTER	P-	PUMP
AFF	AIR CONDITIONING UNIT	GND	GROUND	PB	PULL BOX
AHJ	ABOVE FINISHED FLOOR			PNL	PANEL
AHU-	AUTHORITY HAVING JURISDICTION	H-	HUMIDIFIER	PRV-	POWER ROOF VENTILATOR
AIC	AIR HANDLING UNIT	HI-	HIGH INTENSITY DISCHARGE	PVC	POLY VINYL CHLORIDE
AS	AMPS INTERRUPTING CAPACITY	HOA	HAND-OFF-AUTO SELECTOR SWITCH	PWR	POWER
ATS	ABOVE SHELF	HP	HORSEPOWER		
	AUTOMATIC TRANSFER SWITCH	HR	HOUR	RECEPT	RECEPTACLE
		HVAC	HEATING/VENTILATING/AIR CONDITIONING	RGC	RIGID GALVANIZED STEEL CONDUIT
B-	BOILER			RTU-	ROOF TOP UNIT
BC	BELOW COUNTER	IG	ISOLATED GROUND		
BLDG	BUILDING	IMC	INTERMEDIATE METAL CONDUIT	SF-	SUPPLY FAN
				SPEC	SPECIFICATIONS
CHLR-	CHILLER			SW	SWITCH
CND (C)	CONDUIT	JB	JUNCTION BOX	SWBD	SWITCHBOARD
CKT	CIRCUIT				
CKT BKR	CIRCUIT BREAKER	LC	LIGHT CONTROL	TCC	TEMPERATURE CONTROL CONTRACTOR
CT	COOKING TOWER	LT	LIGHT	TR	TAMPER PROOF RECEPTACLE
CU-	CONDENSING UNIT	LTG	LIGHTING	TS	TAMPER PROOF SWITCH
CUH-	CABINET UNIT HEATER	LT FLEX	LIQUID TIGHT FLEXIBLE METAL CONDUIT	TYP	TYPICAL
DFU-	DUCT FURNACE	MAX	MAXIMUM	UF	UNDER FLOOR
DISC	DISCONNECT	MC	MECHANICAL CONTRACTOR	UH-	UNIT HEATER
DWG	DRAWING	MCC	MOTOR CONTROL CENTER	UL	UNDERWRITERS' LABORATORIES, INC.
DWH-	DOMESTIC WATER HEATER	MIN	MINIMUM	UNO	UNLESS NOTED OTHERWISE
		MLO	MAIN LUG ONLY		
EBB-	ELECTRIC BASEBOARD	MT	MOUNT	V	VOLTS
EC	ELECTRICAL CONTRACTOR	MTD	MOUNTED	VL	VERIFY LOCATION WITH OWNER
EF-	EXHAUST FAN	MTG	MOUNTING		
EM	EMERGENCY	MUAU-	MAKE-UP AIR UNIT	W	WATTS
EMT	ELECTRICAL METALLIC TUBING			W/	WITH
EW	ELECTRIC WATER COOLER	NC	NORMALLY CLOSED	W/O	WITHOUT
EXIST./EX.	EXISTING	NIC	NOT IN CONTRACT	WP	WEATHER PROOF
		NL	NIGHT LIGHT		
		NO	NORMALLY OPEN		
FLA	FULL LOAD AMPS	NTS	NOT TO SCALE	XFMR	TRANSFORMER
FLEX	FLEXIBLE CONDUIT				
FLR	FLOOR				
FLUOR	FLUORESCENT				
FSES	FOOD SERVICE EQUIP. SUPPLIER				
F/S	FIRE/SMOKE				
FU-	FURNACE				

LIGHTING FIXTURE SCHEDULE						
TYPE	MANUFACTURER	CATALOG NO.	DESCRIPTION AND COMMENTS	DIMMING INFO	FIXTURE MOUNTING HEIGHT	DRIVER
LA	LITHONIA H.E. WILLIAMS	FEM-L48-4000LM-L-PAFL-40K-80CRI 96-4-L40-8-40-HIAFR	LED VAPOR TITE FIXTURE WITH IMPACT RESISTANT POLYCARBONATE HOUSING, AND DIFFUSE POLYCARBONATE LENS.	0-10V	VERTICAL WALL	4000 LUMENS, 30 W, 4000K, LED
LB	LITHONIA H.E. WILLIAMS	FEM-L48-4000LM-L-PAFL-40K-80CRI 96-4-L40-8-40-HIAFR	LED VAPOR TITE FIXTURE WITH IMPACT RESISTANT POLYCARBONATE HOUSING, AND DIFFUSE POLYCARBONATE LENS.	0-10V	CEILING OR CHAIN HUNG	4000 LUMENS, 30 W, 4000K, LED
EM	LITHONIA BEGHELLI	ELIML B8X-SE-WHT	BATTERY OPERATED EMERGENCY LIGHT WITH (2) LED LAMPS WITH ADJUSTABLE OPTICS, SEALED MAINTENANCE FREE LEAD NICKLE CADMIUM BATTERY, SOLID STATE CHARGER AND SWITCHING DEVICE, AUTOMATIC OVERLOAD DISCONNECT, AUTOMATIC BROWN OUT FEATURE, HIGH CHARGE - READY INDICATOR LIGHT, AND PUSH TO TEST SWITCH.	-	MOUNT TOP AT 8'-0" UNLESS NOTED OTHERWISE	640 LUMENS, LED

GENERAL ELECTRICAL NOTES

1. ALL WALL AND FLOOR PENETRATIONS ARE TO BE SEALED TO MAINTAIN ORIGINAL RATING.
2. ALL CONDUITS TO BE FIELD ROUTED ALONG EXISTING PIPING AND STRUCTURAL STEEL.
3. THE DIVISION 26 CONTRACTORS SHALL VISIT THE PROJECT AND DETERMINE THE EXACT EXTENT OF THE DEMOLITION WORK REQUIRED BEFORE BIDDING THE PROJECT.
4. REMOVE ALL EXISTING OBSOLETE EXPOSED CONDUIT, WIRE AND UNUSED EQUIPMENT WHERE WORK IS BEING DONE EXCEPT ITEMS NOTED OTHERWISE.
5. WHERE BUILDING SURFACES ARE DAMAGED BY THE REMOVAL OF OLD WORK, SURFACES SHALL BE PATCHED TO MATCH ADJACENT.
6. EXISTING WORK WHICH IS PRESENTLY CONCEALED AND WHICH WILL REMAIN CONCEALED AND DOES NOT INTERFERE WITH ANY NEW WORK OF ANY TRADE NEED NOT BE REMOVED. HOWEVER, ALL CONDUIT SHALL BE CAPPED BELOW FINISH SURFACE AND THEN PATCHED TO MATCH, OR AS NOTED.
7. EXISTING OPENINGS, WHICH ARE TO BE REUSED, SHALL BE MODIFIED OR ENLARGED TO SUIT THE NEW SYSTEMS AS REQUIRED. PROVIDE ALL REQUIRED CUTTING AND PATCHING.
8. IF ASBESTOS IS PRESENT, IT WILL BE REMOVED OR RENDERED HARMLESS UNDER SEPARATE CONTRACT BY THE OWNER.
9. THE DIVISION 26 CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING THE EXISTING WALLS TO MATCH THE ADJACENT SURFACES BEHIND ALL SURFACE MOUNTED EQUIPMENT.
10. CONTRACTOR SHALL FIELD VERIFY ALL EQUIPMENT VOLTAGES AND LOADS PRIOR TO INSTALLING SERVICE TO EQUIPMENT.
11. DRAWINGS ARE BASED ON EXISTING RECORD DOCUMENT AND CASUAL FIELD OBSERVATION. REPORT ANY DISCREPANCIES TO ENGINEER FOR CLARIFICATION.

REVISIONS

9/26/2025	ISSUED FOR BIDS AND PERMITS

DRAWN

—

APPROVED

22

544 Cherbourg Drive
Lansing, MI 48917

PHONE: (517) 487-2511

administrator@matrixceinc.com
Matrix Project No. 24448.00



MATRIX
CONSULTING ENGINEERS, INC.

PROJECT

LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION

**ELECTRICAL
SYMBOLS
ABBREV.
+ NOTES**

DATE _____

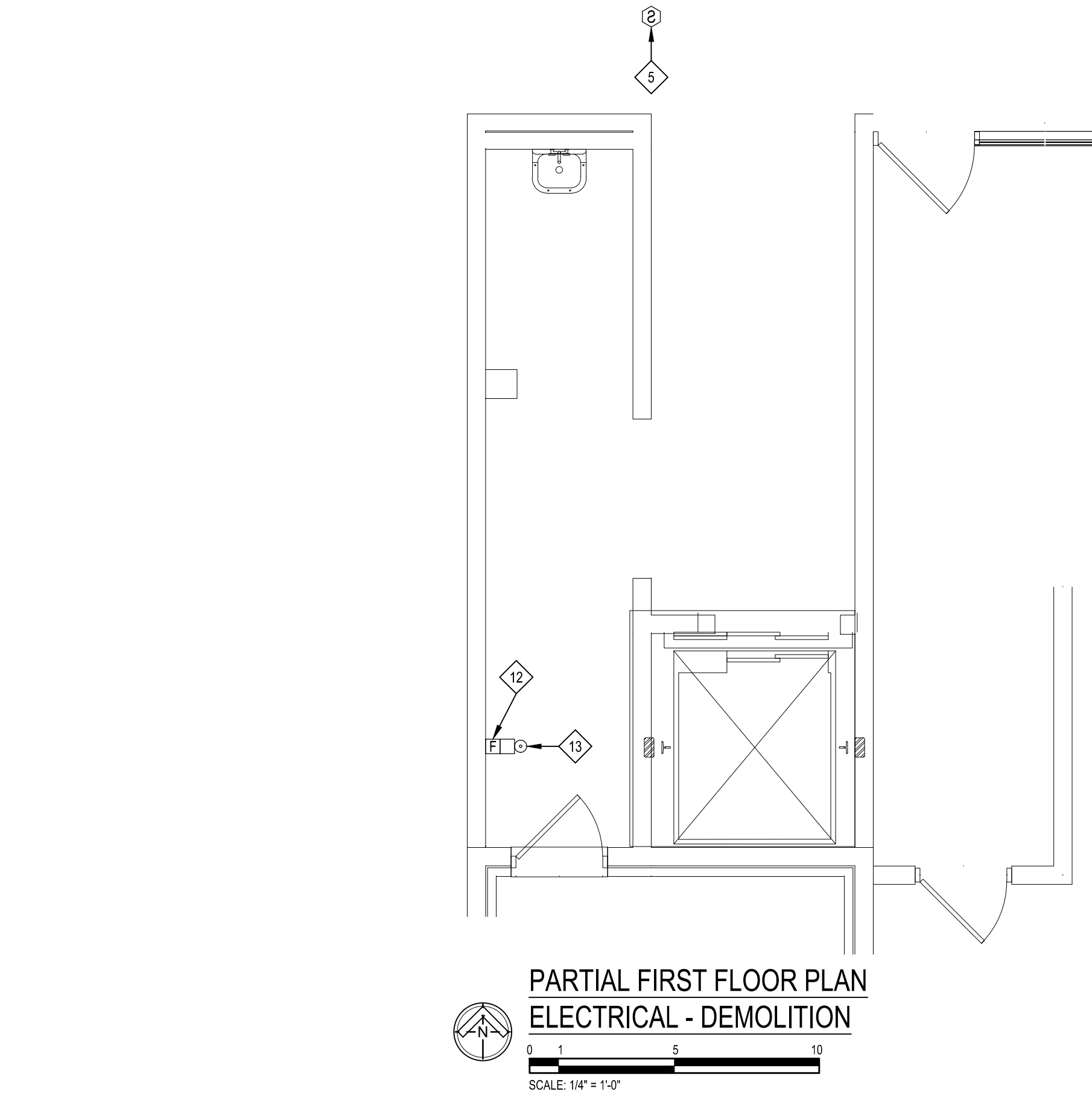
03/24/25

PROJECT NUMBER

24448.00

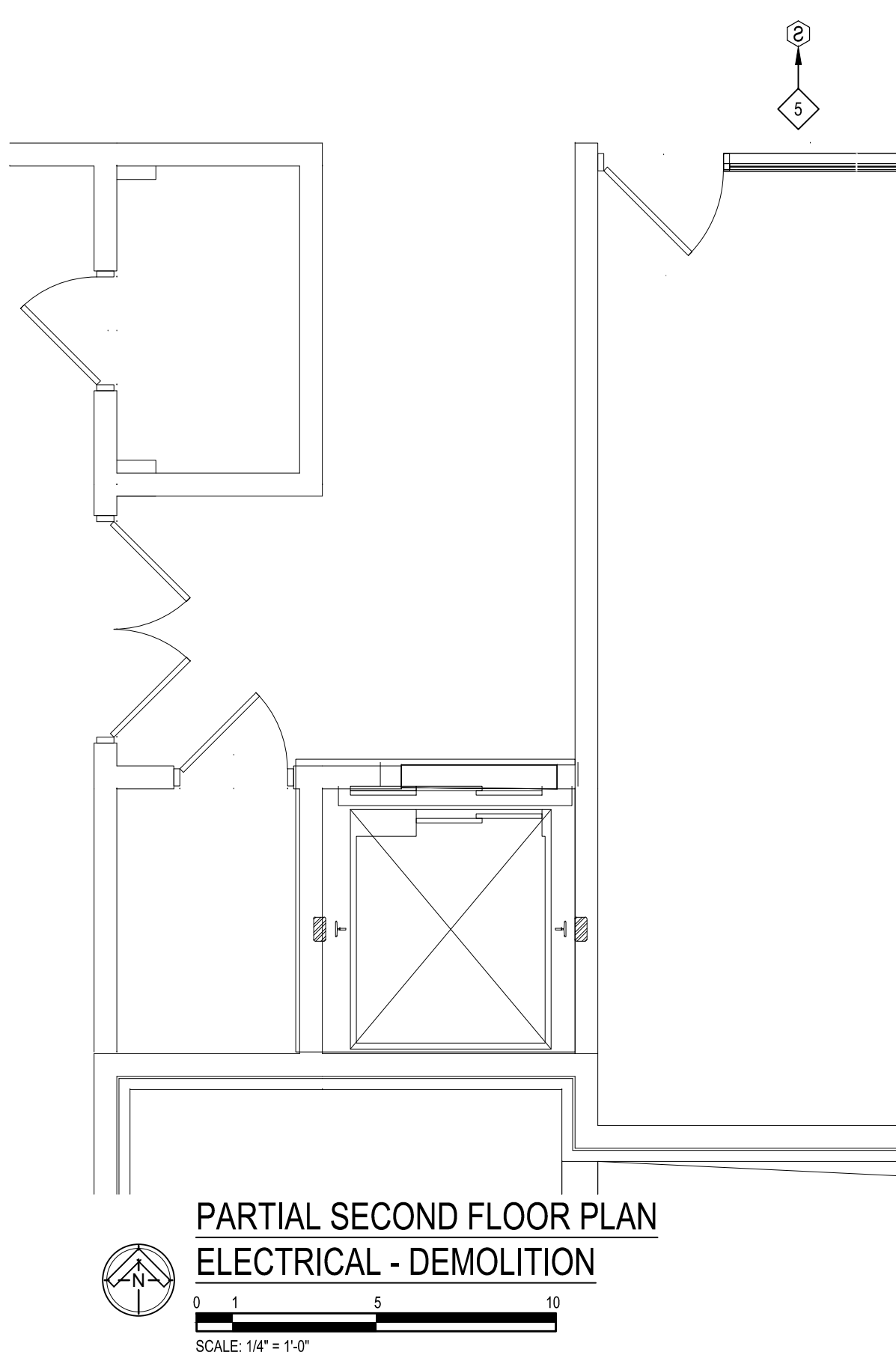
SHEET NUMBER

E-100



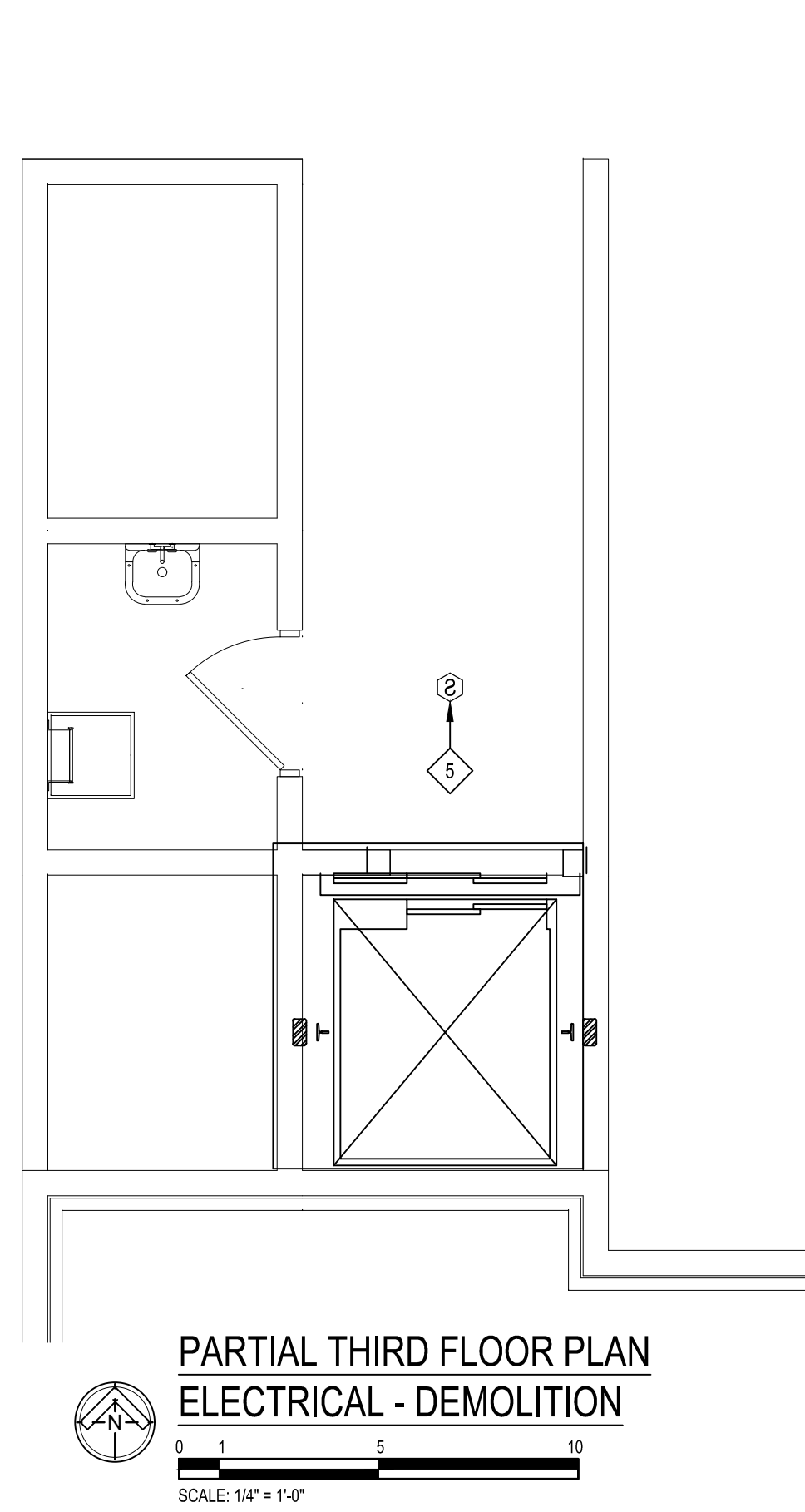
PARTIAL FIRST FLOOR PLAN
ELECTRICAL - DEMOLITION

SCALE: 1/4" = 1'-0"



PARTIAL SECOND FLOOR PLAN
ELECTRICAL - DEMOLITION

SCALE: 1/4" = 1'-0"





0 1 5 10 20

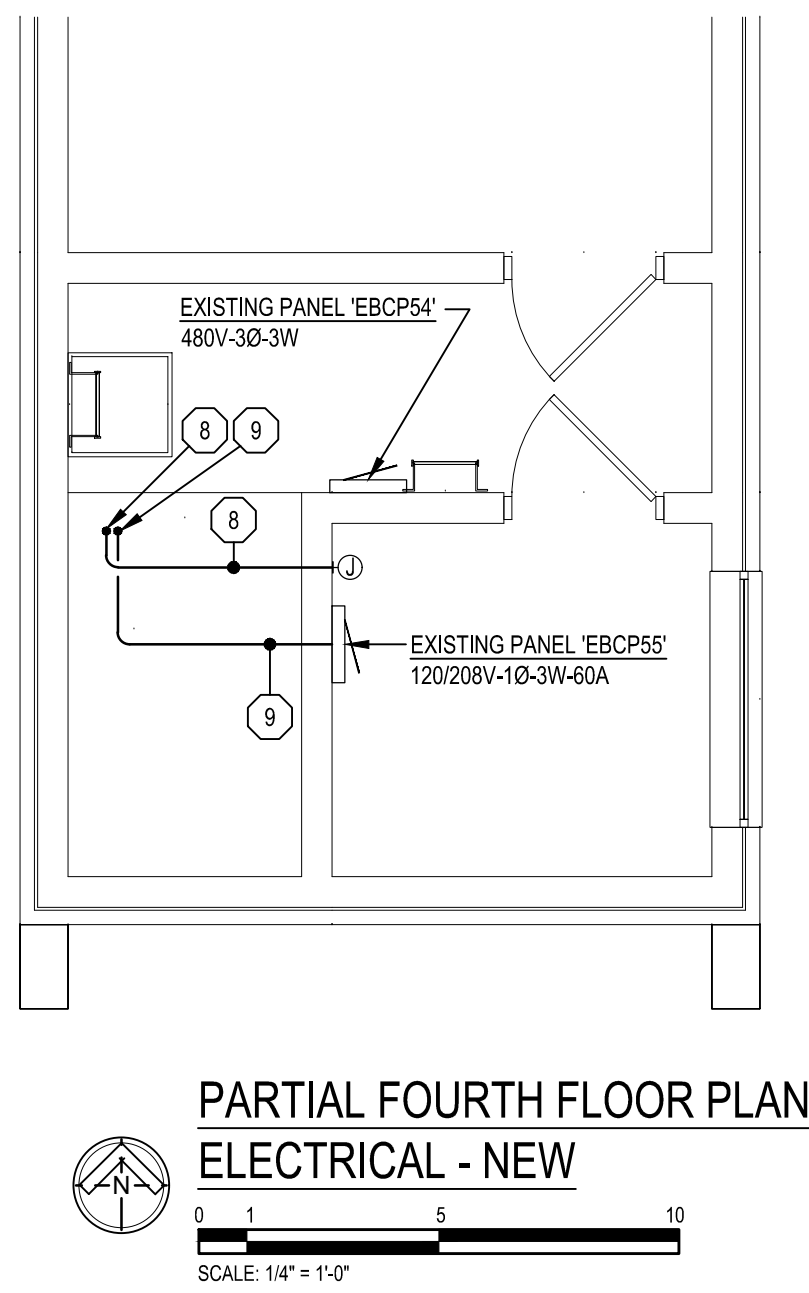
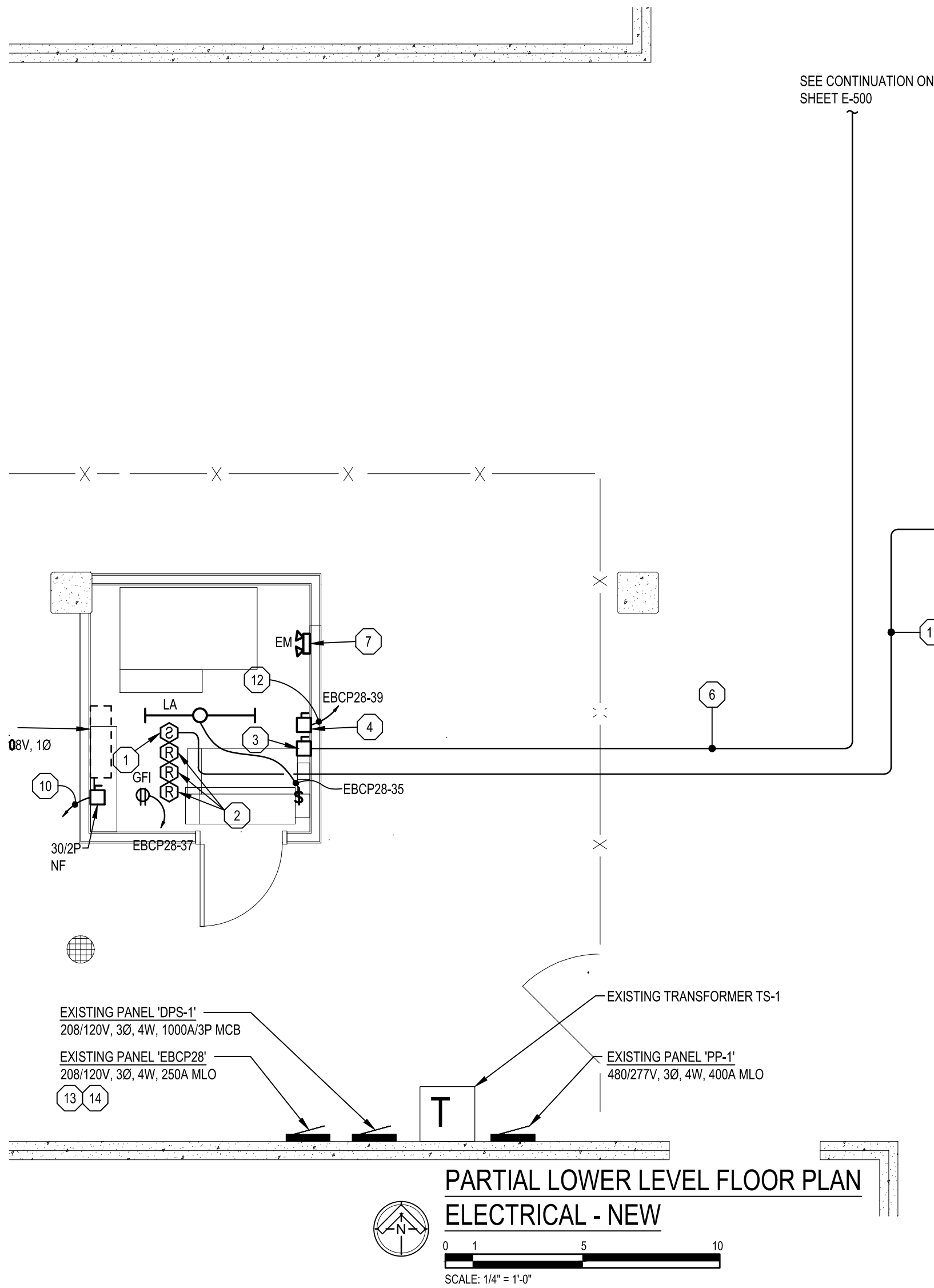
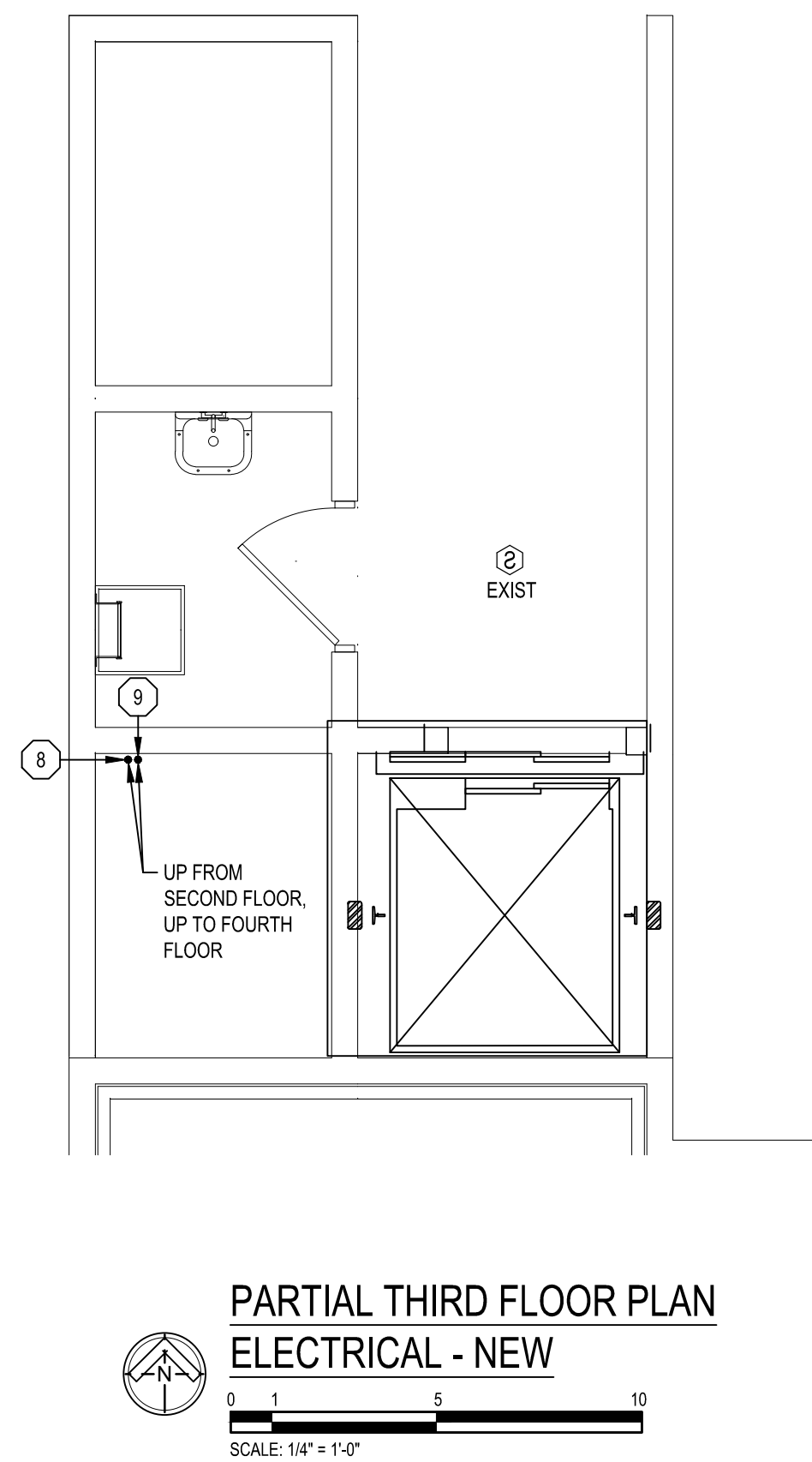
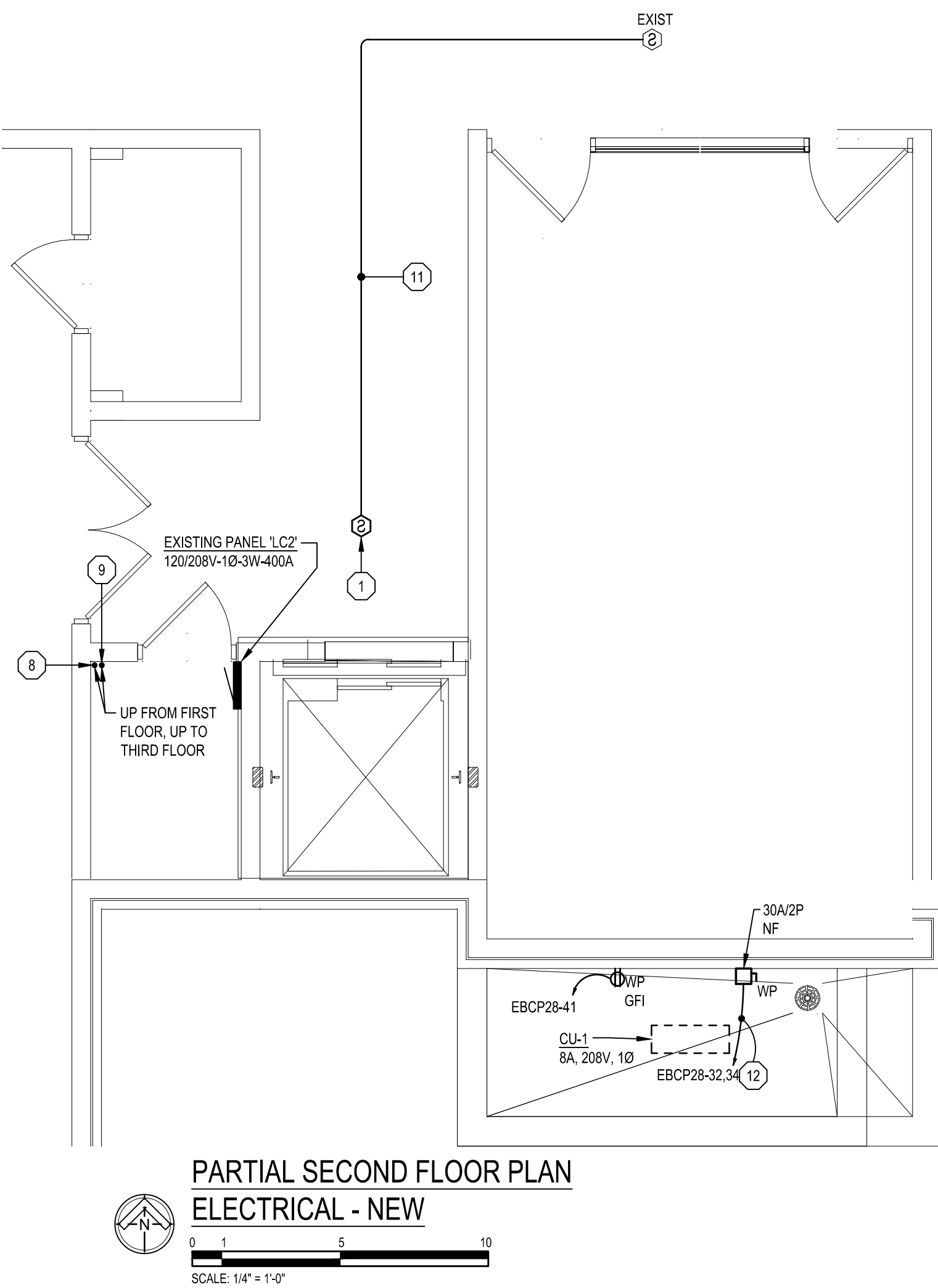
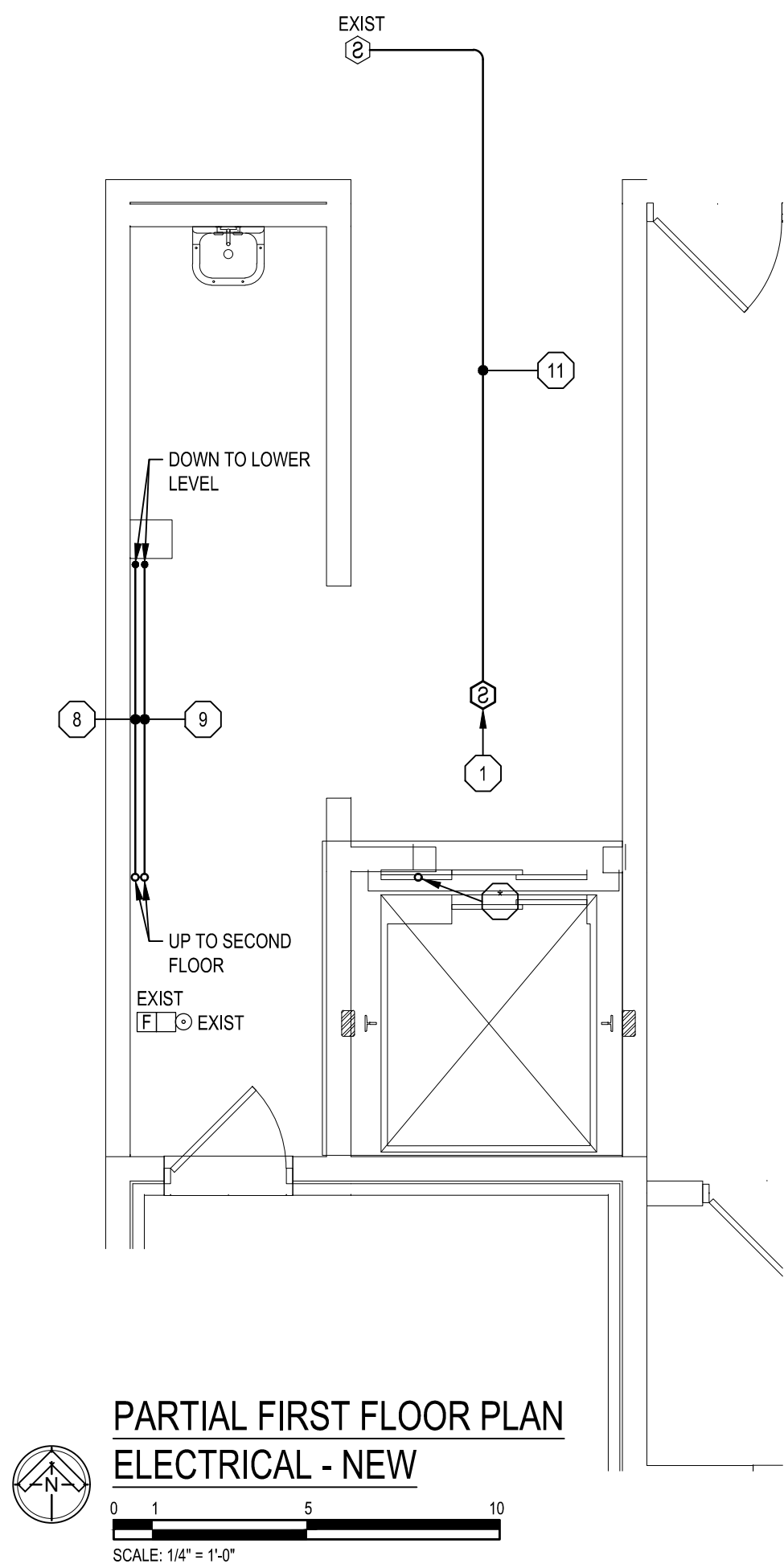
SCALE: 1/8" = 1'-0"

APPROVED

SHEET DESCRIPTION	
1	1

SHEET NUMBER _____

E-500



GENERAL ELECTRICAL NOTES

- CONTRACTOR SHALL HAVE THE FIRE ALARM SYSTEM RE-CERTIFIED UPON COMPLETION OF THE NEW WORK.

ELECTRICAL KEY NOTES

- NEW ADDRESSABLE SMOKE DETECTOR, CONNECT TO EXISTING FIRE ALARM SYSTEM.
- NEW FIRE ALARM ADDRESSABLE RELAY, SEE FIR ALARM MATRIX THIS SHEET.
- NEW 100A/3P HEAVY DUTY DISCONNECT SWITCH FUSED AT 100A.
- NEW 30A/2P HEAVY DUTY DISCONNECT SWITCH FUSED AT 20A FOR ELEVATOR CAB LIGHTS.
- RELOCATED DISCONNECT, TIME CLOCK, CONTACTOR, AND PULL BOX FOR ROOF TRACK LIGHTS.
- (3)#1, (1)#1 GND., (1) 1-1/2" CONDUIT.
- CONNECT EM FIXTURE TO LIGHTING CIRCUIT AHEAD OF ANY SWITCH OR CONTROL DEVICE.
- RUN EXISTING WIRE IN NEW 1-1/2" CONDUIT UP TO FOURTH FLOOR PULLBOX.
- RUN NEW (3) #4, (1)#0 GRD., (1) 1" CND. UP TO NEW PANEL 'EBCP55' AT 4TH FLOOR.
- (2) #12, (1) #12 GRD., (1) 3/4" CND. TO CU-1. SEE SECOND FLOOR PLAN FOR LOCATION.
- NEW (2) #18 TWISTED PAIR, 3/4" CND. CONNECT TO EXISTING FIRE ALARM SMOKE DETECTOR DATA LOOP. VERIFY EXACT WIRE TYPE WITH EXISTING FIRE ALARM MANUFACTURER.
- (2) #12, (1) #12 GRD., (1) 3/4" CND.
- INSTALL NEW 20A/1P CIRCUIT BREAKERS IN EXISTING BLANK SPACES CIRCUITS #31,33,35,37,39,41.
- INSTALL NEW 20A/2P CIRCUIT BREAKER IN EXISTING BLANK SPACES CIRCUITS #32,34.
- INSTALL NEW 125A/3P CIRCUIT BREAKER IN EXISTING BLANK SPACE IN SWITCHBOARD 'HVD1'

ELEVATOR RECALL - FIRE ALARM MATRIX

SYSTEM INPUTS	SYSTEM OUTPUTS						
	R1 RELAY DESIGNATED RECALL	R2 RELAY ALTERNATE RECALL	R3 RELAY WARNING	ANNUNCIATOR RECALL STATUS	GENERAL ALARM	TROUBLE STATUS	SUPERVISORY STATUS
LOWER LEVEL LOBBY INITIATING DEVICE	●			●	●		
FIRST FLOOR LOBBY INITIATING DEVICE		●		●	●		
SECOND FLOOR LOBBY INITIATING DEVICE	●			●	●		
THIRD FLOOR LOBBY INITIATING DEVICE	●			●	●		
LOWER LEVEL CONTROLLER ROOM INITIATING DEVICE	●		●	●	●		

REVISIONS	

ISSUED FOR BIDS AND PERMITS	

544 Cheaburg Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Main Project No. 24448.0

MATRIX
CONSULTING ENGINEERS, INC.

PROJECT
LANSING SCHOOL DISTRICT
SEXTON ELEVATOR REPLACEMENT - BID SO-1842
102 MCPHERSON
LANSING, MI 48915

SHEET DESCRIPTION
PARTIAL ELECTRICAL PLANS - NEW

DATE
03/24/25

PROJECT NUMBER
24448.00

SHEET NUMBER
E-501

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

J.W. Sexton High School Elevator Upgrades
102 McPherson Ave
Lansing, MI 48915

THE OWNER:

(Name, legal status and address)

Lansing School District
519 W Kalamazoo St
Lansing, MI 48933

THE ARCHITECT:

(Name, legal status and address)

Matrix Consulting Engineers
544 Cherbourg Drive
Lansing, MI 48917

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS**
- 2 OWNER**
- 3 CONTRACTOR**
- 4 ARCHITECT**
- 5 SUBCONTRACTORS**
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**
- 7 CHANGES IN THE WORK**
- 8 TIME**
- 9 PAYMENTS AND COMPLETION**
- 10 PROTECTION OF PERSONS AND PROPERTY**
- 11 INSURANCE AND BONDS**
- 12 UNCOVERING AND CORRECTION OF WORK**

ADDITIONS AND DELETIONS:

The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.



ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES



INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, **12.3**

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,
10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,
3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and
Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2,
4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4,
9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7,
9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4

Certificates of Insurance

9.10.2

Change Orders

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

Change Orders, Definition of
7.2.1

CHANGES IN THE WORK

2.2.2, 3.11, 4.2.8, 7, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5

Claims, Definition of

15.1.1

Claims, Notice of

1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4

Claims and Timely Assertion of Claims

15.4.1

Claims for Additional Cost

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

Claims for Additional Time

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

Concealed or Unknown Conditions, Claims for
3.7.4

Claims for Damages

3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration

15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to

2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of

8.1.2

Communications

3.9.1, **4.2.4**

Completion, Conditions Relating to

3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND
9

Completion, Substantial

3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2

Compliance with Laws

2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY
SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of
7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR
SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**

Contract Sum, Definition of

9.1

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal
Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Contractor's Employees

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors and Owner's Forces

3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors

1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6,

10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1
 Contractor's Representations
 3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
 Contractor's Responsibility for Those Performing the Work
 3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
 Contractor's Review of Contract Documents
 3.2
 Contractor's Right to Stop the Work
 2.2.2, 9.7
 Contractor's Right to Terminate the Contract
 14.1
 Contractor's Submittals
 3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3
 Contractor's Superintendent
 3.9, 10.2.6
 Contractor's Supervision and Construction Procedures
 1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
 Coordination and Correlation
 1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
 Copies Furnished of Drawings and Specifications
 1.5, 2.3.6, 3.11
 Copyrights
 1.5, **3.17**
 Correction of Work
 2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1
Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
 Costs
 2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14
Cutting and Patching
3.14, 6.2.5
 Damage to Construction of Owner or Separate Contractors
 3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
 Damage to the Work
 3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
 Damages, Claims for
 3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7
 Damages for Delay
 6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2
Date of Commencement of the Work, Definition of
8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
 Decisions of the Architect
 3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification

9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of
 2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

Definitions

1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time

3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission

1.7

Disputes

6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site

3.11

Drawings, Definition of

1.1.5

Drawings and Specifications, Use and Ownership of
 3.11

Effective Date of Insurance

8.2.2

Emergencies

10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work

1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work

(See Defective or Nonconforming Work)

Final Completion and Final Payment

4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's

2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, **10.3**

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5, 9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,

11

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of

8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,

10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Liens

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,

4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,

11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,

5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,

15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, 10.3

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,

10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and

Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,

15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of

2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4,

3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4,

8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1,

13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5,

15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5,

15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections

13.4.1, 13.4.2

Observations, Contractor's

3.2, 3.7.4
Occupancy
2.3.1, 9.6.6, 9.8
Orders, Written
1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

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

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

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

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

Partial Occupancy or Use

9.6.6, 9.9

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Project, Definition of

1.1.4

Project Representatives

4.2.10

Property Insurance

10.2.5, **11.2**

Proposal Requirements

1.1.1

PROTECTION OF PERSONS AND PROPERTY

10

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Rejection of Work

4.2.6, 12.2.1

Releases and Waivers of Liens

9.3.1, 9.10.2

Representations

3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10

Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field Conditions by Contractor

3.2, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and

Samples by Contractor

3.12
Rights and Remedies
 1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, **13.3**, 14, 15.4
Royalties, Patents and Copyrights
3.17
 Rules and Notices for Arbitration
 15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
 3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
 3.11, **3.12**, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
 Schedules, Construction
 3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
 Separate Contracts and Contractors
 1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
 3.11, **3.12**, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
 Site Inspections
 3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
 Site Visits, Architect's
 3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
 Special Inspections and Testing
 4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
 1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
 Statute of Limitations
 15.1.2, 15.4.1.1
 Stopping the Work
 2.2.2, 2.4, 9.7, 10.3, 14.1
 Stored Materials
 6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
 Subcontractors, Work by
 1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
 Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3
 Submittal Schedule
 3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
 6.1.1, **11.3**
Substances, Hazardous
10.3
Substantial Completion
 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2, 15.1.2
Substantial Completion, Definition of
9.8.1
 Substitution of Subcontractors
 5.2.3, 5.2.4
 Substitution of Architect
 2.3.3
 Substitutions of Materials
 3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2
 Subsurface Conditions
 3.7.4
Successors and Assigns
13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
 1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4
 Suppliers
 1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1
 Surety
 5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7
 Surety, Consent of
 9.8.5, 9.10.2, 9.10.3
 Surveys
 1.1.7, 2.3.4
Suspension by the Owner for Convenience
14.3
 Suspension of the Work
 3.7.5, 5.4.2, 14.3
 Suspension or Termination of the Contract
 5.4.1.1, 14
Taxes
 3.6, 3.8.2.1, 7.3.4.4
Termination by the Contractor
14.1, 15.1.7
Termination by the Owner for Cause
 5.4.1.1, **14.2**, 15.1.7
Termination by the Owner for Convenience
14.4
 Termination of the Architect
 2.3.3
 Termination of the Contractor Employment
 14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT

14

Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, **13.4**

TIME

8

Time, Delays and Extensions of

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, **8.3**, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK

12

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, **15.1.7**

Waiver of Claims by the Owner

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, **15.1.7**

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, **11.3**

Warranty

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2

Written Interpretations

4.2.11, 4.2.12

Written Orders

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

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

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the

purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 3.3 Supervision and Construction Procedures

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

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

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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

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

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

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

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

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

constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

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

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

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

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the

Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

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

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

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

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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

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

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

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

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

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

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

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

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

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

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

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

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

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

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

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

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

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

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

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

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

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

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

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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

whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

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

§ 9.4 Certificates for Payment

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

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

- or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

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

§ 9.6 Progress Payments

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

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

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

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

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

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

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

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

- .1 employees on the Work and other persons who may be affected thereby;

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

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

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

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

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

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

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve

the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

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

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

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

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

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

fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

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

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

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

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

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

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

approvals where building codes or applicable laws or regulations so require.

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

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

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

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

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

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

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

§ 15.2 Initial Decision

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

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

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

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

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

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

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner

may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

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

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially

similar procedural rules and methods for selecting arbitrator(s).

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

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



Additions and Deletions Report for

AIA® Document A201® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 12:35:35 EDT on 10/07/2025.

Changes to original AIA text

There are no edits to the original text

Variable Information

PAGE 1

J.W. Sexton High School Elevator Upgrades

102 McPherson Ave
Lansing, MI 48915

Lansing School District

519 W Kalamazoo St
Lansing, MI 48933

Matrix Consulting Engineers

544 Cherbourg Drive
Lansing, MI 48917